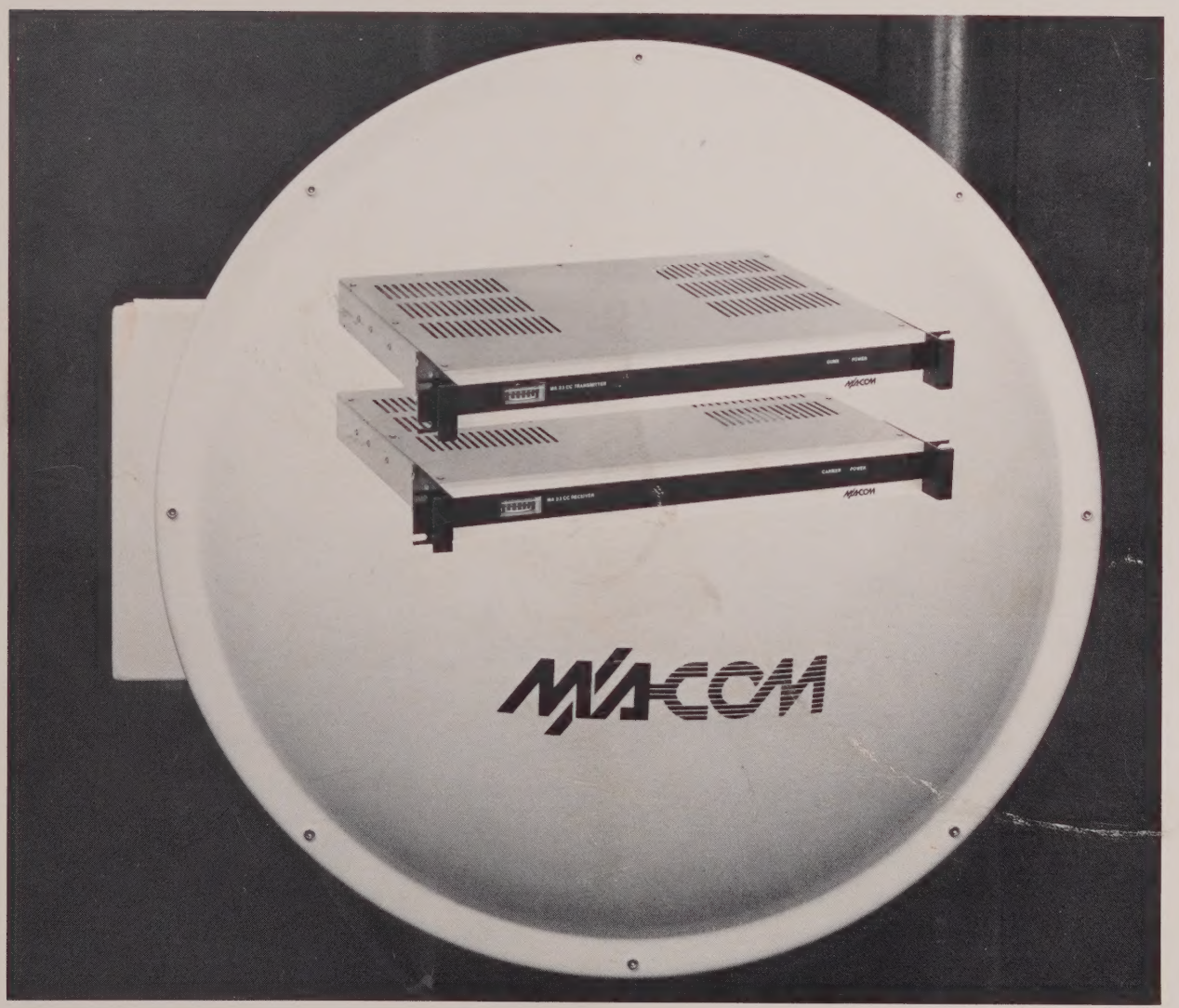
IM 808814A

MA-23CC

23 GHz WIDEBAND

MICROWAVE RADIO SYSTEM



INSTALLATION AND OPERATION MANUAL

MP MASTER
MA29168

WARNING

MA-23CC BASEBAND UNITS ARE DESIGNED FOR INDOOR USE. TO REDUCE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE UNITS TO RAIN OR MOISTURE.

CAUTION

This installation should be made by qualified service personnel and should conform to all local and national codes.

The services of a structural engineer are recommended to insure that mounting of outdoor equipment (antennas, RF boxes, etc.) does not constitute a hazard to personnel and does not exceed tower or structural load ratings under anticipated environmental conditions.

CAUTION

MA-23CC Systems are provided with lightning surge protection circuits. The equipment must be connected to station ground using standard grounding practices in accordance with all local and national codes.

M/A-COM MAC, Inc. will not be liable for damages to equipment incurred as a result of failure to ground the system properly.

CAUTION

To reduce the risk of electric shock, do not remove cover. No user serviceable parts inside.

Refer servicing to qualified service personnel.

CAUTION

For continued protection against fire, replace fuses only with same type (as marked).

Refer replacement of internal fuses to qualified service personnel.

PROPRIETARY NOTICE

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Specifications are subject to change in order to allow the introduction of design improvements.

M/A-COM MAC, INC.
5 OMNI WAY
CHELMSFORD, MA 01824
(617) 272-3100
(800) 343-3006 (Outside MA)
(800) 643-9600 (Within MA)

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SECTION 1
EQUIPMENT DESCRIPTION

GENERAL

The MA-23CC System is a low cost, solid-state FM analog microwave radio system that provides up to 12 MHz of baseband bandwidth in the 21.2 to 23.6 GHz frequency band with a full range of system options. The MA-23CC System is ideal for a wide variety of professional broadcast quality and high resolution video applications up to 15 miles. With the use of high speed modems, the MA-23CC can be used for data transmission up to 12.5 Mbps, or up to 8 T1 (192 phone lines).

The MA-23CC adapts to a wide range of applications including teleconferencing, medical, and CAD/CAM image transmission, satellite backhaul, and surveillance. It is normally used for one or two-way transmission of full color 525 line video with up to three audio subcarriers. In the medical and CAD/CAM markets, it is used for high resolution (1024 x 1024 lines) video transmission.

The compact, lightweight MA-23CC System is engineered to provide troublefree performance and simplicity of operation with a full range of system configuration options. Easy access is provided to all RF and electronic assemblies. Transmitter and Receiver antenna assemblies consist of weather-resistant integrated antenna/RF assemblies designed for outdoor use and rack mountable indoor Transmitter and Receiver Baseband Units containing power supply and baseband circuits. Interconnection between indoor and outdoor units is via coax cable and power cable.

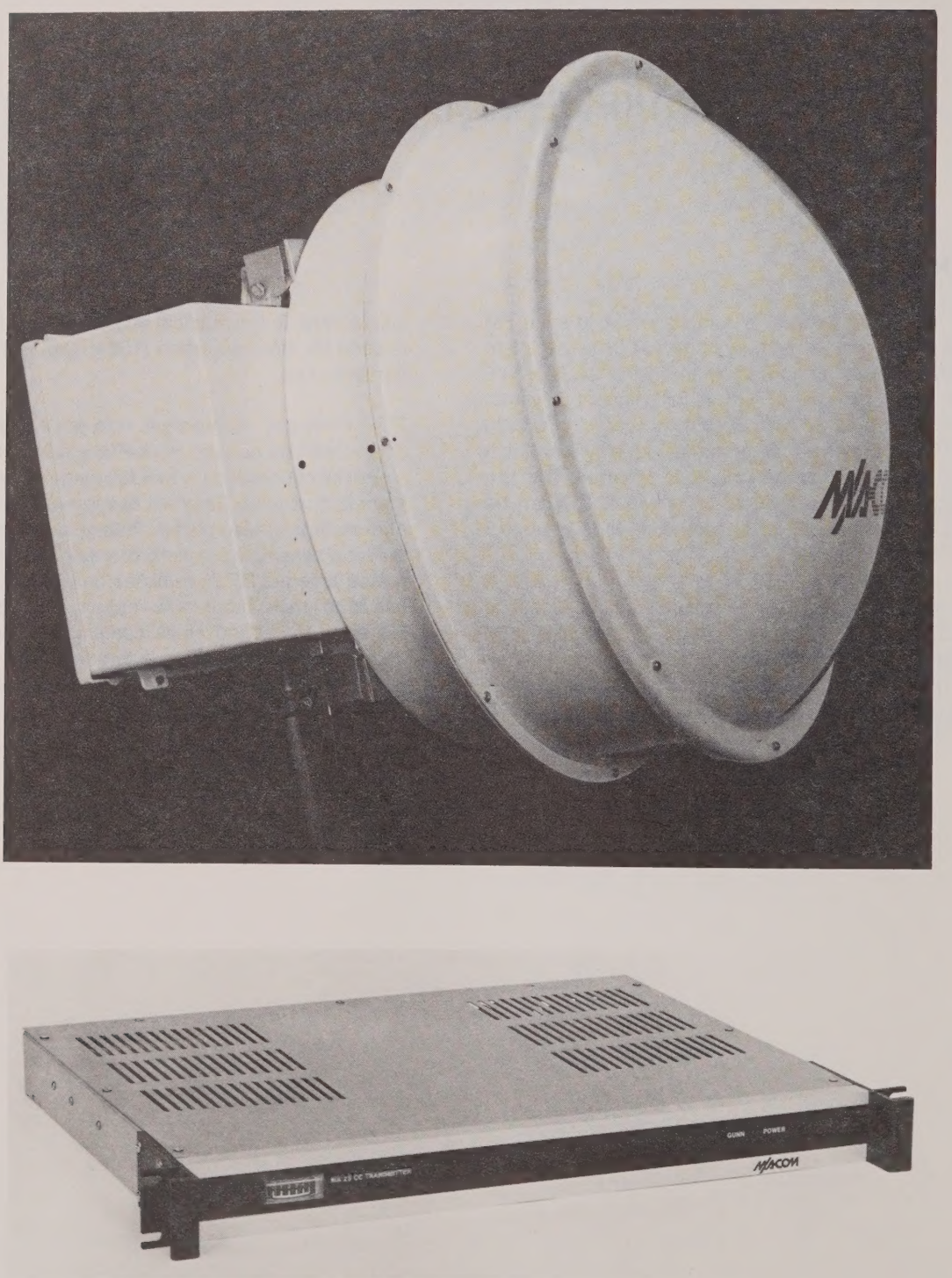


Figure 1-1. Equipment of a MA-23CC Duplex Link – One End of Link

SPECIFICATIONS

GENERAL

Operating Frequency Range
- Common Carrier,
  - Part 21 ..... 21.225 to 21.775 GHz
    22.425 to 22.975 GHz
- Private Operational,
  - Part 94 ..... 21.825 to 22.375 GHz
    23.025 to 23.575 GHz

Channel Spacing (RF) ..... 50 MHz
Modulation ..... FM
Input/Output
- Video ..... 75 ohm coax BNC
- Audio ..... twisted pair

Video Capacity
- Standard ..... 525/625 Line
- Optional ..... 1024 x 1024 Line

Audio Capacity ..... up to 3 audio subcarriers. Each subcarrier can carry up to 56 Kbs data. Optional configurations can carry T1 (1.544 Mbps).

Baseband Bandwidth
- Standard ..... 10 MHz
- Optional ..... up to 12 MHz (±3 dB) with roll-off to 20 MHz

Video Signal-to-Noise ..... 67 dB typical (with −35 dBm RCL)
FM Deviation ..... ±4 MHz
Power Requirements
- Standard ..... 120/230 Vac (50 to 60 Hz),
- Optional ..... 24 or 48 Vdc

Power Consumption
- Transmitter 40W
- Receiver 45W

Optional ..... RS-250B Short-Haul Performance Specifications

VIDEO PERFORMANCE (−40 dBm RCL, 250′ Cable Kit)

Video Bandwidth ..... 12 MHz maximum, with roll-off to 20 MHz
Frequency Response Output
- 525 Line (10 kHz to 4.2 MHz) ..... ±0.5 dB
- 625 Line (10 kHz to 5.5 MHz) ..... ±0.5 dB

Chrominance/Luminance
- Gain Inequality ..... ±5%
- Delay Inequality ..... 50 ns

Waveform Distortion
- Field Time ..... ±1%
- Line Time 3%
- Short Time ..... 5% P-P

Differential Gain (10 to 90% APL) . ±2% maximum
Differential Phase (10 to 90% APL) ..... ±1°
Signal-to-Noise Ratio (P-P/RMS/CCIR Weighted)
- 10 kHz to 5.5 MHz ..... 67 dB typical; 63 dB minimum

Signal-to-Hum Ratio (P-P/RMS)
- 10 Hz to 10 kHz ..... 60 dB

Pre- and De-Emphasis ..... per CCIR Rec. 405
Video Squelch Point ..... 37 dB S/N ± 3 dB adjustable

AUDIO PERFORMANCE (Up to 3 Subcarriers)

Standard Frequency Options ..... 6.2, 6.8, or 7.5 MHz subcarrier frequency
Audio Frequency Response (Ref 1 kHz)
- 50 Hz to 15 kHz ..... ±1 dB

Data Carrying Capacity ..... 56 Kbps with modem
Deviation (0 dBm Input) ..... 75 kHz peak
Total Harmonic Distortion
- Ref 100 kHz Peak Deviation ..... less than 1%

Signal-to-Noise Ratio
- Ref 100 kHz Peak Deviation ..... 60 dB

TRANSMITTER

Power Output (at output of source)
- Minimum ..... 50 mW (+17 dBm)
- Typical ..... 66 mW (+18 dBm)
- Maximum ..... 100 mW (+20 dBm)

Frequency Stability ..... ±0.03% (−30 to +50°C)
Spurious Response ..... meets FCC Part 94 and Part 21 requirements
Video Input
- Level ..... 1V P-P
- Impedance ..... 75 ohms
- Return Loss ..... 30 dB minimum

Audio Input
- Level ..... 0 dBm
- Impedance ..... 600 ohms balanced

RECEIVER

Type ..... superheterodyne
Noise Figure ..... 12 dB typical
Video Output ..... 1V P-P, 75 ohms
Audio Output ..... +9 dBm, 600 ohms balanced
Receiver Threshold ..... −75 dBm (37 dB weighted S/N)
IF ..... 140 MHz

STATUS INDICATORS AND ALARMS

TX Metering ..... TX Source Current
RX Metering ..... AGC Voltage
Visual Alarm TX (LED) ..... TX Source Current; Prime Power
Visual Alarm RX (LED) ..... IF Lock; Prime Power
Summed Alarm (TX and RX) ..... Form C Dry Relay Contact

OPERATING ENVIRONMENT

Temperature Range
- RF Unit ..... −30 to +50°C
- Baseband Unit ..... +10 to +40°C

Relative Humidity
- RF Unit ..... up to 100%
- Baseband Unit ..... up to 95%

All specifications are subject to change without notice.

SPECIFICATIONS (CONT)

PHYSICAL

Size (TX or RX)
- RF Unit ..... 6.5″ (h) x 12″(d) x 9.875″ (w) (16.5 x 30.5 x 25.1 cm)
- Baseband Unit ..... 1.75″ (h) x 13″ (d) x 19″ (w) (4.5 x 33.0 x 48.3 cm)

Weight
- RF Unit – Simplex TX ..... 7 lbs. (3.2 kg)
- RF Unit – Simplex RX ..... 8 lbs. (3.6 kg)
- RF Unit – Duplex ..... 9 lbs. (4.1 kg)
- TX Baseband Unit ..... 9 lbs. (4.1 kg)
- RX Baseband Unit ..... 9.5 lbs. (4.3 kg)

Interconnection Cables ..... 50, 100, 250 foot standard kits. Up to 1000 feet on request.

FCC DATA

Type Accepted ..... Parts 21 and 94
FCC Identifier BV88U4MA23CC
Emission Designator 25M0F8W

ANTENNAS

2 Foot Model (Simplex, Duplex, or Multiplex)
- Size ..... 24″ diameter (0.6m)
- Type ..... FCC Category A
- FCC Licensed Use . Entire Part 21 and 94 bands
- Gain (includes radome loss) ..... 40 dBi
- Beamwidth (3 dB) ..... 1.8°
- Effective Radiated Power (ERP) ..... 58 dBm
- Mount ..... 3″ to 4″ pole or wall
- RF Interface ..... WR-42 choke and “O” ring
- Weight ..... 24 lbs. (10.9 kg)
- Windloading (w/Radome at 125 mph)
  - F_S ..... 90 lbs. (40.9 kg)
  - F_A ..... 110 lbs. (50.0 kg)
  - MT ..... 125 lbs. (56.8 kg)

4 Foot Model (Simplex, Duplex, or Multiplex)
- Size ..... 48″ diameter (1.2m)
- Type ..... FCC Category A
- FCC Licensed Use . Entire Part 21 and 94 bands
- Gain (includes radome loss) ..... 46.5 dBi
- Beamwidth (3 dB) ..... 0.8°
- Effective Radiated Power (ERP) ..... 63 dBm
- Mount ..... 3″ to 4″ pole or wall
- RF Interface ..... WR-42 choke and “O” ring
- Weight ..... 65 lbs. (29.5 kg)
- Windloading (w/Radome at 125 mph)
  - F_S ..... 315 lbs. (143.1 kg)
  - F_A ..... 640 lbs. (290.7 kg)
  - MT ..... 815 lbs. (370.2 kg)

6 Foot Model (Simplex, Duplex, or Multiplex)
- Gain (includes radome loss) ..... 49.5 dBi
- Beamwidth (3 dB) ..... 0.6°
- Contact factory for additional specifications.

All specifications are subject to change without notice.

SECTION 2
FUNCTIONAL DESCRIPTION

GENERAL

The basic MA-23CC System consists of a weather-resistant Antenna/RF Assembly designed for outdoors use and rack mountable Transmitter/Receiver Baseband Units with interconnecting RF and power cables.

ANTENNA/RF ASSEMBLY

The standard 2 foot antenna is designed so that the RF Assembly can be mounted on the rear of the antenna. When optional 4 foot or 6 foot antennas are used, the RF Assembly must be mounted separately.

The flexible design of the RF Assembly allows it to be configured for standard duplex (transmit-receive) or as a simplex (transmit or receive) when used with stacking/combiner kits for multiplexing.

TRANSMITTER BASEBAND UNIT

The indoor Transmitter Baseband Unit contains a Baseband Board and Power Supply module which powers all Transmitter subsystems (indoor and outdoor). The Baseband Board provides mounting and electrical interconnection facilities for a Video Low Pass Filter and up to three plug-in subcarrier boards.

All signal connections to and from the Transmitter Baseband Unit are made at the rear of the chassis. These include the video input signal (VIDEO IN), the auxiliary baseband input signal (BB IN), the baseband output signal (BB OUT), the audio/data input signals (AUDIO 1, AUDIO 2, AUDIO 3), and summary alarm connections (ALARM).

The Transmitter Baseband Unit has a front panel meter to monitor Gunn Source current. Front panel LED's indicate when TX Gunn Source current is within acceptable limits and prime power is present. When prime power is lost or TX Gunn Source current exceeds its limits, summary alarm dry relay contacts (Form C) are extended for supervisory use.

RECEIVER BASEBAND UNIT

The indoor Receiver Baseband Unit contains a Baseband Board, an IF Filter-Equalizer Board, and Power Supply module which powers all Receiver subsystems (indoor and outdoor). The Baseband Board provides mounting and electrical interconnection facilities for a Video Low Pass Filter and up to three plug-in subcarrier boards.

All signal connections to and from the Receiver Baseband Unit are made at the rear of the chassis. These include the IF input signal (IF IN), the video output signal (VIDEO OUT), the baseband output signal (BB OUT), the audio/data output signals (AUDIO 1, AUDIO 2, AUDIO 3), and summary alarm connections (ALARM).

The Receiver Baseband Unit has a front panel meter to monitor AGC voltage. Front panel LED's indicate when RF signals are received and prime power is present. When prime power is lost or RF signals are not received, summary alarm dry relay contacts (Form C) are extended for supervisory use.

SYSTEM CONFIGURATIONS

Typical system configurations of the MA-23CC System are shown in Figures 2-1 and 2-2. Only one antenna is required at each end of the link for all configurations shown.

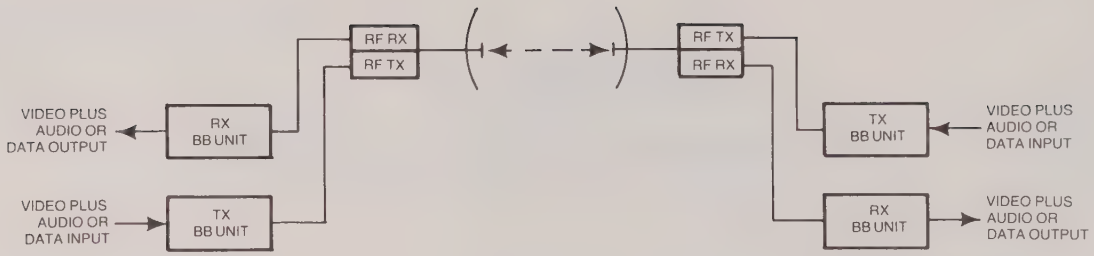


Figure 2-1. Duplex Link Configuration

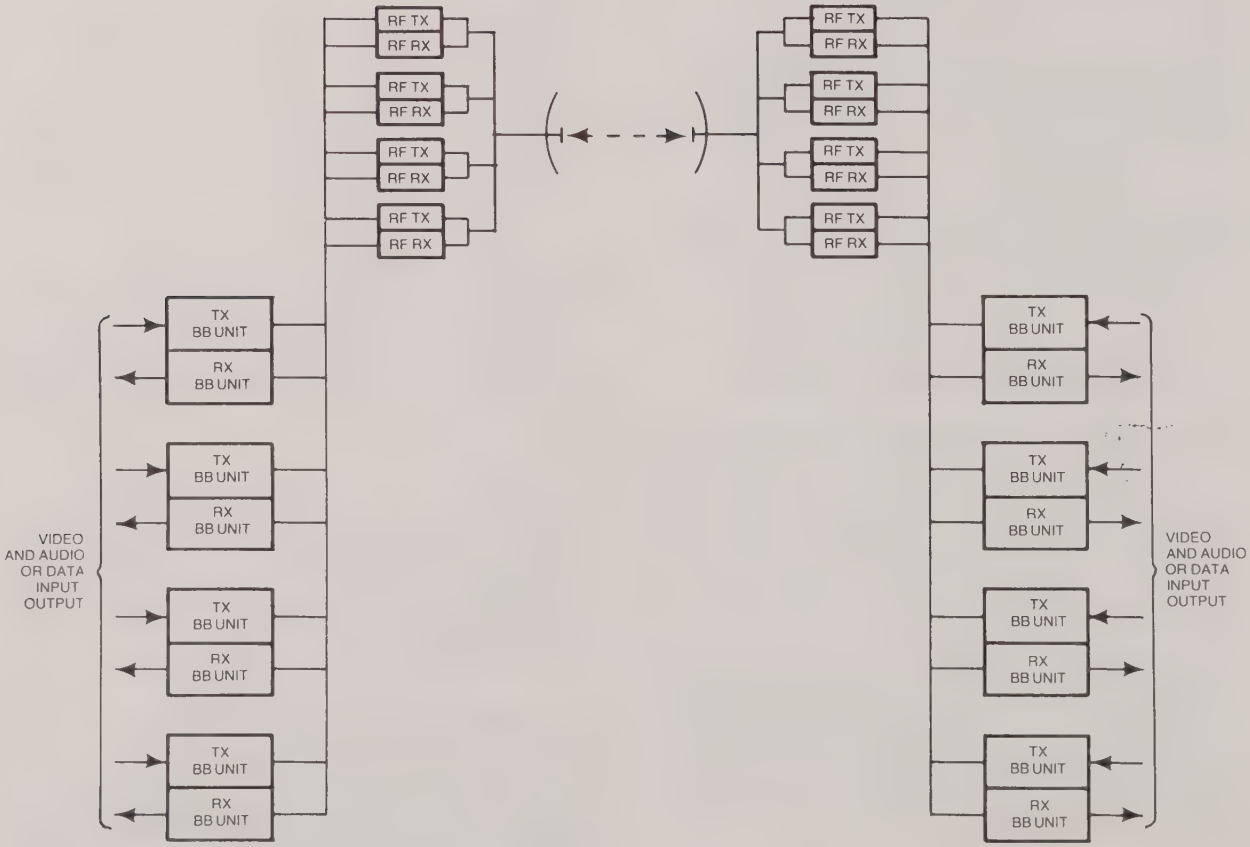


Figure 2-2. Multiplexed Link Configuration (1 to 4 Simplex or Duplex Channels)

SIGNAL FLOW

TRANSMITTER SUBSYSTEM (Figure 2-3). The incoming video, baseband, and audio/data signals are processed and combined into a composite baseband signal. This signal is amplified to a level of 2V peak-to-peak at the baseband output connector for routing via the coaxial interconnection cable to the outdoor RF Assembly.

The baseband signal from the Transmitter Baseband Unit enters the weather-tight enclosure of the outdoor RF Assembly unit via a Type F bulkhead connector. The signal is adjusted for a modulation sensitivity of 4 MHz peak and combined with a regulated bias voltage to frequency modulate the 23 GHz Transmitter Gunn Source. The modulated 23 GHz carrier is routed via a Ferrite circulator to the antenna for transmission over the line-of-sight (LOS) microwave path to the other end of the link.

RECEIVER SUBSYSTEM (Figure 2-4). The incoming 23 GHz RF signal is received at the antenna and routed via the Ferrite circulator and a bandpass filter to a waveguide mixer for downconversion to the 140 MHz IF of the Receiver. A temperature stabilized Gunn Local Oscillator provides the LO signal to the mixer. The 140 MHz IF signal is preamplified and fed to an AGC IF Amplifier that provides a constant IF output signal level of approximately −6 dBm. The 140 MHz IF signal and a buffered AGC voltage exit the weather-tight RF Assembly enclosure via a Type F bulkhead connector. These signals are sent to the indoor Receiver Baseband Unit via a small diameter coaxial interconnection cable.

The 140 MHz IF signal from the outdoor RF Assembly unit is received at the IF IN coaxial connector of the Receiver Baseband Unit. Here, the incoming IF signal is bandpass filtered and equalized, limited, and then demodulated to recover the baseband signal. At the same time, the AGC signal is fed to the Receiver squelch and meter circuits. The recovered baseband signal is fed to a baseband amplifier that produces two outputs. One output is applied to a Video Low Pass Filter to produce a 1V peak-to-peak video output at the VIDEO OUT connector. The other output of the baseband amplifier drives an amplifier stage that provides the subcarrier distribution buss and a 1V peak-to-peak composite baseband output at the BB OUT connector. The buss routes the baseband signal to the installed subcarrier boards where the transmitted audio/data signals are recovered. The output impedance of the audio/data signals are strappable for either low impedance (50 ohms) or 600 ohm balanced outputs at the AUDIO output connectors.

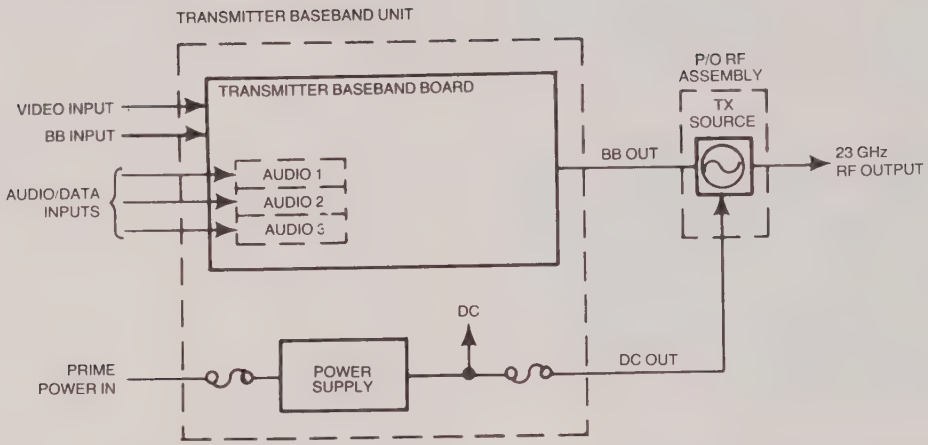


Figure 2-3. Transmitter Subsystem

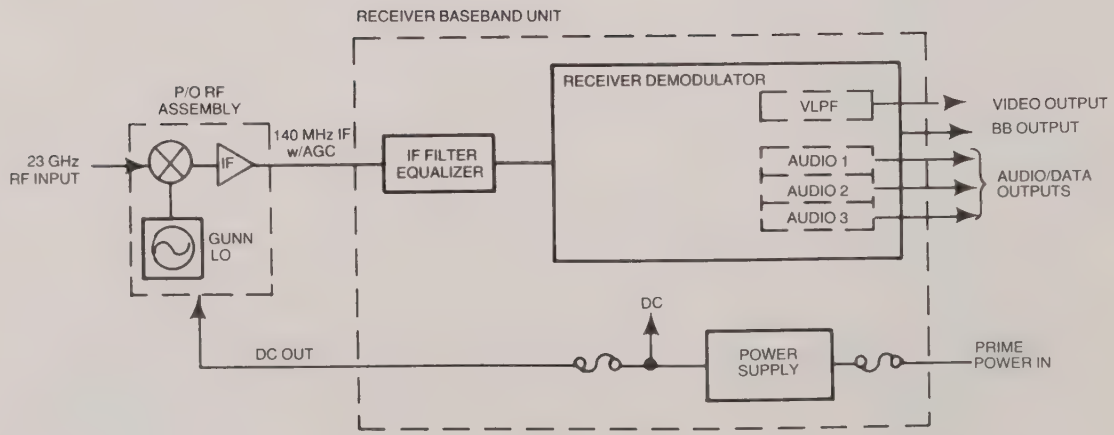


Figure 2-4. Receiver Subsystem

SECTION 3
INSTALLATION

GENERAL

Installation of the system, including antenna alignment, is a relatively simple procedure as outlined in this section of the manual. However, the installer should be thoroughly knowledgeable of the system and all factors which may affect performance. Therefore, it is strongly recommended that the installer read the complete manual and become as familiar as possible with the system before proceeding with installation of equipment.

CAUTION

This installation should be made by qualified service personnel and should conform to all local codes.

The services of a structural engineer are recommended to insure that mounting of outdoor equipment (antennas, RF boxes, etc.) does not constitute a hazard to personnel and does not exceed tower or structural load ratings under anticipated environmental conditions.

UNPACKING AND HANDLING

UNPACKING. Table 3-1 lists the equipment shipped in the equipment crate of typical 23 GHz systems.

Care should be taken when removing equipment from containers to prevent damage to the units. Ensure that all parts and accessories are removed from the container and packing material before they are discarded.

DO NOT discard the container or any packing material until mechanical inspection has been satisfactorily completed. This material must be available if a damage claim is to be made with the carrier.

MECHANICAL INSPECTION. Mechanically inspect the equipment for shipping damage. Make sure that the equipment is clean and no connectors, controls or indicators are broken, damaged, or loose.

DAMAGE IN SHIPMENT. Should any damage be discovered after unpacking the system, immediately file a claim with the carrier. A full report of the damage should be made and a copy forwarded to your M/A-COM dealer. The dealer will then advise disposition of the equipment.

RETURN AUTHORIZATION. Subject to standard terms of the warranty policy, M/A-COM MAC, Inc., or its dealers, will repair all defective equipment.

Contact your dealer before returning any equipment for repair. A Return Authorization Tag which is available from your dealer on behalf of M/A-COM must accompany any returned goods. Your dealer will provide instructions for forwarding material to his repair facility, or when necessary, to M/A-COM's Chelmsford, Massachusetts factory.

NOTE

Do not alter any internal controls unless so directed in the following procedures. Units are completely aligned at the factory and may require only minor adjustments once installed.

TOOLS REQUIRED (Not Supplied). The following tools are required to install a typical 23 GHz system:

1. 5/16″ box wrench
2. screwdriver set – standard (slotted) and Phillips
3. adjustable wrench (6″ or 8″)
4. safety collar
5. crimping tool
6. sealing compound
7. high impedance digital voltmeter (DVM)
8. two-way radios
9. 140 MHz frequency counter
10. inclinometer
11. rachet – 1/2″ drive with socket sets (standard and deep)
12. magnetic compass

Additional tools may be required for the following:

a. Masonry Installations – Hilti Power Drill and Kwik Bolts (as required)

b. Optional 4 Foot Antenna

PRECAUTIONS

Adherence to the initial installation precautions outlined in Table 3-2 will help prevent problems arising during installation and operation of the equipment.

Table 3-1. Equipment List

DESCRIPTION	DUPLEX SYSTEM	MULTIPLEX SYSTEMS[1,2]
INDOOR EQUIPMENT		
Transmitter Baseband Unit	2	2N
Receiver Baseband Unit	2	2N
OUTDOOR EQUIPMENT		
Duplex RF Assembly (Unprotected)	2	2N
2 Foot Parabolic Antenna[3]	2	2
Antenna Mounting Bracket	2	2
Multiplex Mounting Channel	—	2
OPTIONAL INTERCONNECTION CABLES[4]		
RF Cables	4	4N
Power Cable (8-Conductor)	2	2N

Notes:
1. Multiplex systems available with up to four duplex channels using a single antenna at each site.
2. N equals the number of duplex channels.
3. Optional 4 foot or 6 foot high performance antennas and mounting brackets will be shipped in separate crates. Mounting brackets will be shipped with the RF Units.
4. Normally, RF and power interconnection cables are fabricated by the installer (connectors are provided). However, cables are optionally available from the factory in standard lengths of 50 feet (15 meters), 100 feet (30 meters), or 250 feet (75 meters).

Table 3-2. Installation Precautions

PRECAUTION	REQUIREMENT
Ensure adequate ventilation.	Allow a minimum of one rack space above and below each unit mounted in the rack to prevent heat build-up. If an enclosed cabinet is used, a ventilation fan is recommended.
Ensure easy access to rack wiring.	Allow a minimum of 18 inches clearance behind the equipment racks.
Facilitate servicing and maintenance.	Allow a minimum of 36 inches clearance in front of equipment racks.
Avoid direct heating or air conditioning.	If unavoidable, use deflector plates.
AC power source outlets.	Locate equipment near sufficient outlets to provide power for test equipment and power tools. Also verify condition of ac line voltage to determine if an uninterruptible power supply (UPS) is required.
Rack support.	Make certain rack supports are sufficiently rigid to support the rack.
Building leakage.	Beware of dripping water onto equipment from leaky roofs, cable entries, and cold water pipe condensations.
Service access (outdoor units).	Be sure to provide sufficient clearance to permit opening of access doors for servicing purposes.
Grounding (see Caution).	Ground the antenna mounts, outdoor RF Units, and interconnection cables to a structural or station ground to prevent damage from lightning and to eliminate ground loops. Ground and bond all equipment within equipment rack to each other and to a common station ground.
Service loops.	Use service loops at each end of flexible cable runs.
Weatherproof connectors.	Apply RTV sealant to all exposed connectors.
Ice shields.	In certain geographical areas where tower structures may be subject to a radial ice buildup of 1/2 inch or more, provide overhead ice shield protection.

CAUTION

Systems are provided with lightning surge protection circuits. The equipment must be connected to station ground using standard grounding practices in accordance with all local and national codes.

M/A-COM MAC, Inc. will not be liable for damages to equipment incurred as a result of failure to ground the system properly.

INSTALLATION GUIDELINES

GENERAL. Installation of 23 GHz Systems require real-time communications between each end of the link to properly align the antennas.

The following tasks must be performed by the installer in the order listed. Detailed procedures for each of these tasks follow this listing.

1. Fabricate the RF and power interconnection cables (if not purchased already fabricated).

2. Install the RF and power interconnection cables between the predetermined indoor and outdoor equipment locations.

3. Install the indoor units in the equipment rack.

4. Prepare the antenna/RF assembly for installation.

    a. Elevation tilt range.
    b. Antenna polarization.
        1) Option A – horizontal polarization.
        2) Option B – vertical polarization.

5. Mount the outdoor equipment in their predetermined outdoor locations.

6. Connect RF and power interconnection cables to RF Units.

7. Connect RF and power interconnection cables to indoor units.

8. Electrical interface and power connections.

    a. Data interface connections.
    b. Alarm interface connections.
    c. Primary power connections.
        1) Option A – dc powered systems.
        2) Option B – ac powered systems.
    d. Grounds.

FABRICATE RF AND POWER INTERCONNECTION CABLES

Significant changes have been made in the 1987 National Electrical Code (NEC) regarding the installation of cables in commercial buildings. The revised codes are effective on July 1, 1988. The NEC guidelines become law when adopted by local or state governing authorities at which time they may stipulate more or less stringent requirements. M/A-COM recommends that all users planning installations on or after July 1, 1988 ensure that cables conform to the applicable code requirements.

NOTE

M/A-COM MAC will not be liable for penalties or damages incurred by failure to comply with local or national codes for electrical cables.

RF and power interconnection cables (between the indoor and outdoor units) may be purchased from the factory or fabricated by the user prior to installation. Cables meeting revised NEC requirments for "General Use (NEC Class CL2, CL3, or CATV)" or "Plenum (NEC Class CL2P, CL3P, or CATVP)" are available from the factory in standard lengths of 50 feet (15 meters), 100 feet (30 meters), or 250 feet (75 meters). Note that cables meeting NEC requirements for "Plenum" use may also be used in "Riser" applications (see Tables 3-3 and 3-4).

Cables installed outdoors are not required to meet the NEC flame/smoke retardant requirements. After using cable conforming to the codes within the building up to a bulkhead connector at the point of entry to the building, other cable may be used outdoors (from the bulkhead connector to the outdoor RF Terminal) provided it is mechanically and electrically equivalent to the cables recommended by M/A-COM.

For signal cable assembly, see Figure 3-1. Details of power cable fabrication are provided in Figures 3-2 through 3-4. Be sure to mark all cable ends to ensure proper connections wh en installed.

Interconnection daigrams are shown in Figures 3-5 through 3-7.

Table 3-3. Power Interconnection Cables

APPLICATION	NEC CLASS/MAC PART NO.[1]		NO. OF CONDUCTORS[2]	CONNECTOR PART NO. (REF)
	PLENUM	GENERAL USE		
TX Simplex	1842030-1-xxxx	1842030-2-xxxx	4	88358-94
RX Simplex	1841932-1-xxxx	1841932-2-xxxx	4	88358-94
Duplex	1841933-1-xxxx	1841933-2-xxxx	8	88358-94

Notes: 1. xxxx × cable length in feet.
2. Conductor sizes: 0-250 Feet = No. 18 AWG; 251-500 Feet = No. 16 AWG; 501-800 Feet = No. 14 AWG; and 801-1000 Feet = No. 12 AWG.

Table 3-4. RF Interconnection Cables

APPLICATION	QUANTITY REQUIRED	NEC CLASS/MAC PART NO.[1]		
		PLENUM	GENERAL USE	CONDUIT/OUTDOOR
TX Simplex	1	1841885-1-xxxx	1841885-2-xxxx	1841885-3-xxxx
RX Simpliex	1	1841885-1-xxxx	1841885-2-xxxx	1841885-3-xxxx
Duplex	2	1841885-1-xxxx	1841885-2-xxxx	1841885-3-xxxx

Notes: 1. xxxx = cable length in feet.
2. Cable/connector type: 0-250 ft. = RG-6/U double shielded/Gilbert GFX-6-9; 251-400 ft. = RG-11/U double shielded/Gilbert BF-11-AHS/460; 401-500 ft.* = 0.412 trunk/Gilbert GRS-412-BAFF-A-01; 401-500 ft. = 0.500 trunk/Gilbert GRS-500-BAFF-A-01; 501-800 ft.* = 0.750 trunk/Gilbert GRS-750-BAFF-A-01; 801-1000 ft.* = 1.0 trunk/Gilbert GRS-1000-BAFF-A-01.

*Asterisked items not available for plenum or general use.

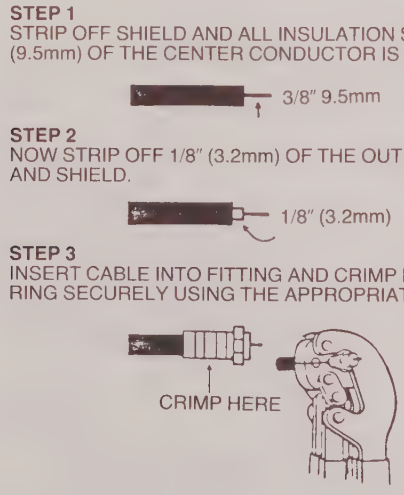

STEP 1
STRIP OFF SHIELD AND ALL INSULATION SO THAT 3/8" (9.5mm) OF THE CENTER CONDUCTOR IS EXPOSED.
3/8" 9.5mm
STEP 2
NOW STRIP OFF 1/8" (3.2mm) OF THE OUTER JACKET AND SHIELD.
1/8" (3.2mm)
STEP 3
INSERT CABLE INTO FITTING AND CRIMP FERRULE OR RING SECURELY USING THE APPROPRIATE OPENING.
CRIMP HERE

Figure 3-1. Signal Cable Assembly

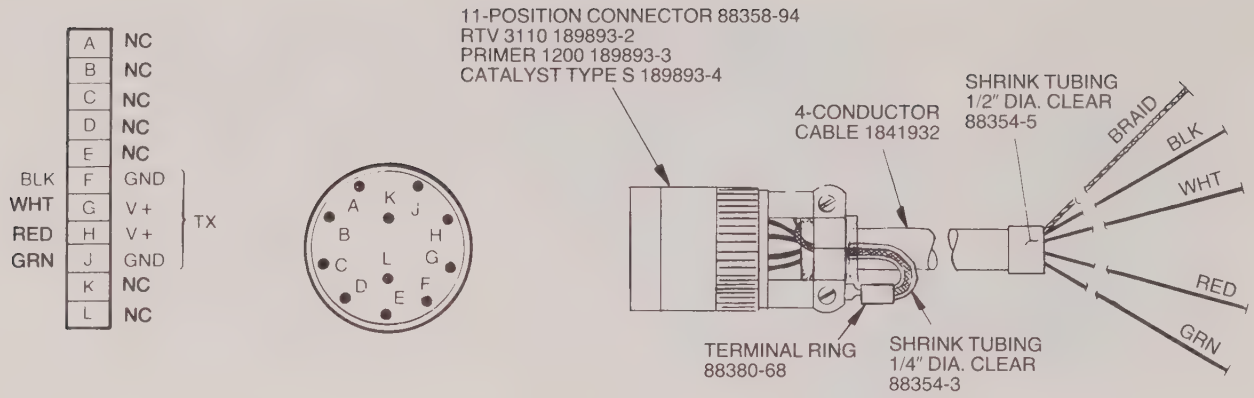


Figure 3-2. Transmitter Simplex Power Cable PN 1842030

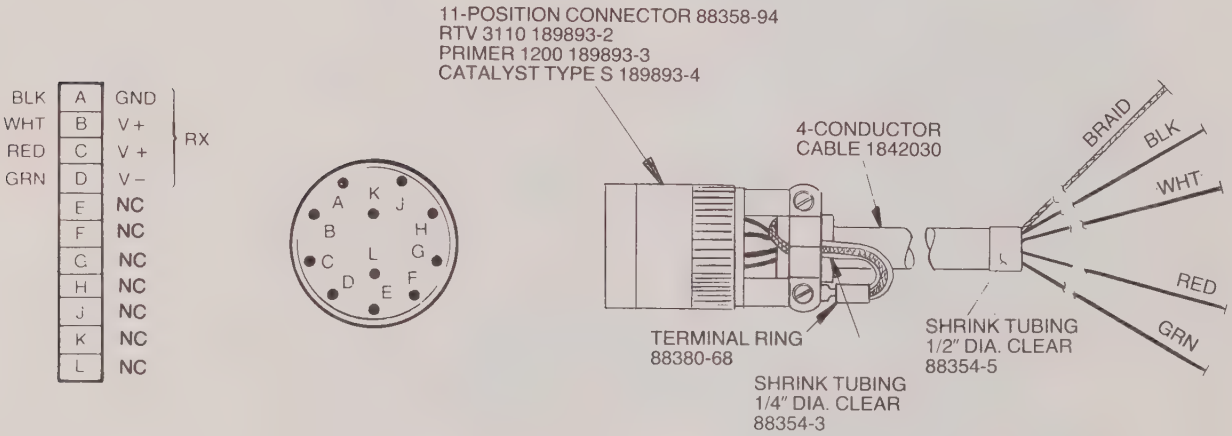


Figure 3-3. Receiver Simplex Power Cable PN 1841932

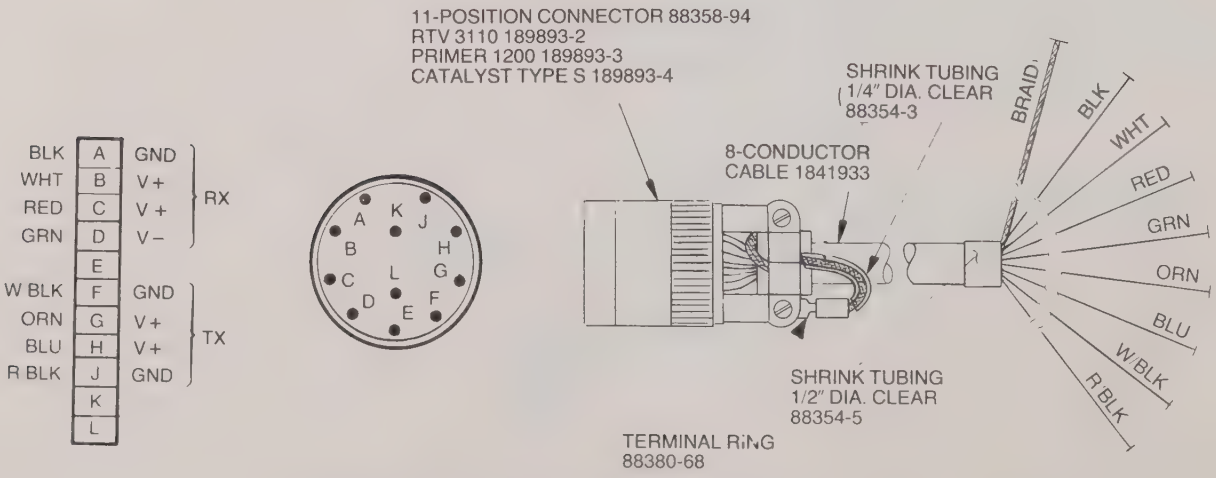


Figure 3-4. Duplex Power Cable PN 1841933

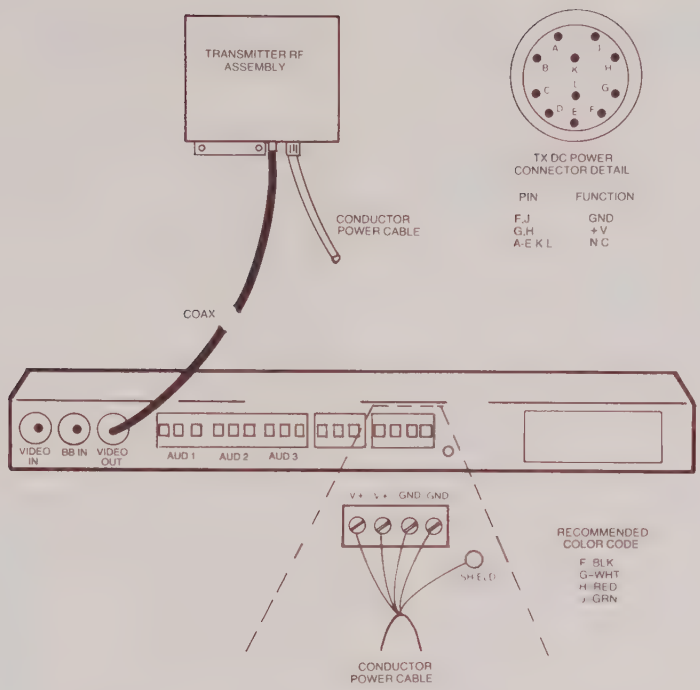


Figure 3-5. Simplex Transmitter (Used With Stacking/Combiner Kits Only)

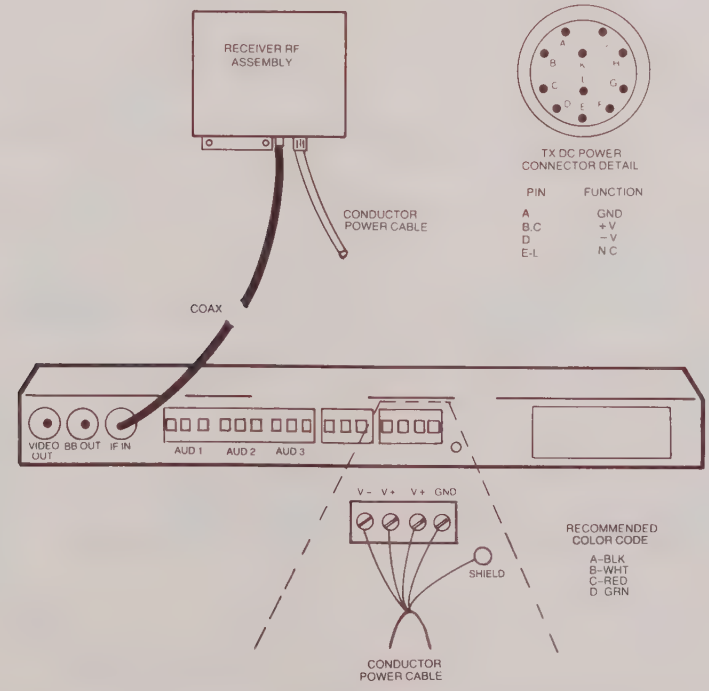
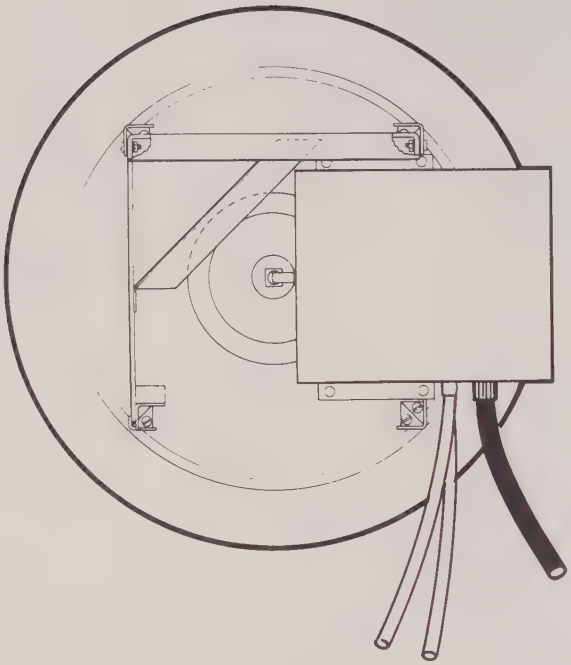
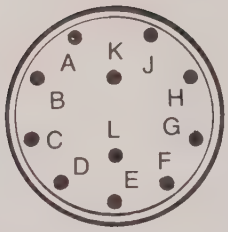


Figure 3-6. Simplex Receiver (Used With Stacking/Combiner Kits Only)





DUPLEX DC POWER CONNECTOR DETAIL

PIN	FUNCTION
A	RX GND
B,C	RX +V
D	RX –V
E,K,L	N.C.
F,J	TX GND
G,H	TX +V

RECOMMENDED COLOR CODE

A – BLK
B – WHT
C – RED
D – GRN
F – W/BLK
G – ORN
H – BLU
J – R/BLK

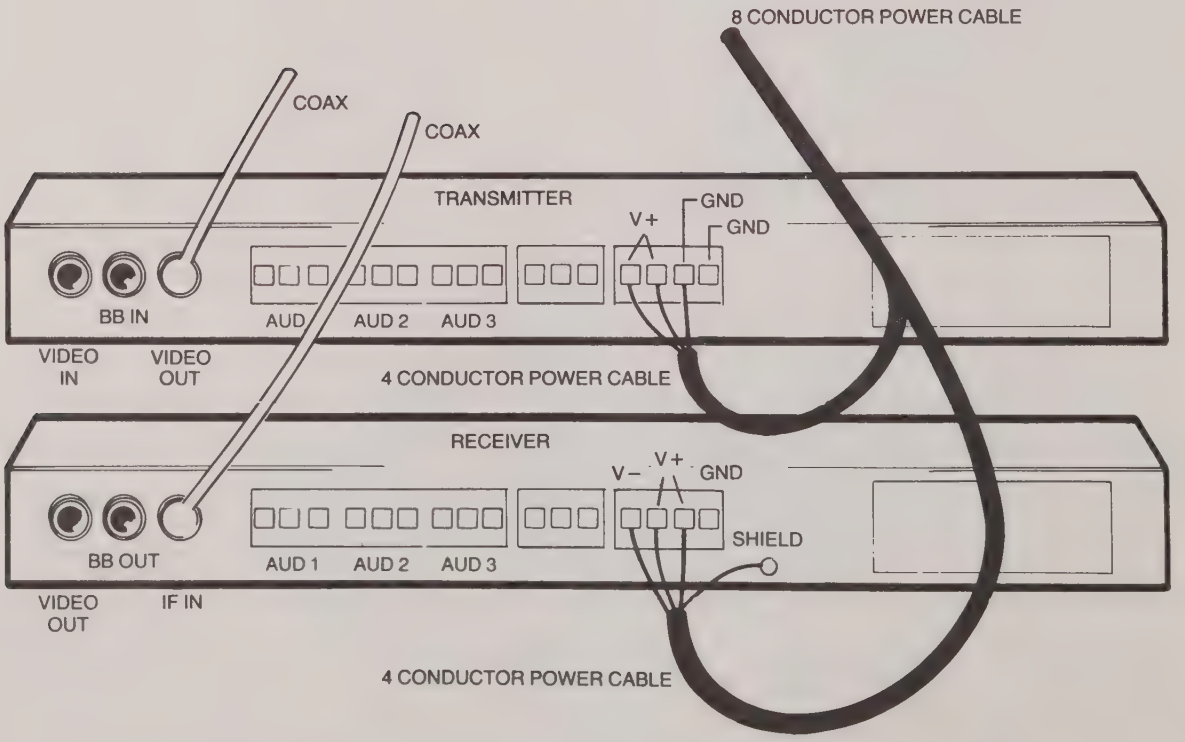


Figure 3-7. One End of Duplex Link

INSTALLATION OF INTERCONNECTION CABLES

Run the RF and power interconnection cables between the indoor and outdoor units. Follow standard cabling practices. Avoid sharp corners and secure cables to tower or mast using hangers installed at three foot intervals. Use service loops at each end of flexible cable runs. The interconnection cables are carrying low voltages and as such do not require enclosure within conduits based on the applicable National Electrical Code (NEC). However, the use of conduit is recommended when the cables are installed in heavy traffic areas or subject to adverse environments.

Although 23 GHz systems are equipped with lightning surge protection, it is necessary to ground interconnection cables using commercially available grounding kits. One grounding kit should be installed at the Antenna/RF Assembly location on the tower or mast and a second kit should be applied to the interconnection cables at the base of the tower, or just before it enters the building.

INSTALLATION OF INDOOR UNITS

The indoor components of 23 GHz systems are designed for installation in standard 19-inch EIA equipment racks in a well ventilated area. The Transmitter and Receiver Baseband Units each occupy a single rack space (1-3/4 inches).

Install the units in the rack allowing at least one rack space above and below each unit mounted in the rack using (2) 12/24-3/4″ screws.

Be sure to observe the precautions noted in Table 3-2.

WARNING

BASEBAND UNITS ARE DESIGNED FOR INDOORS USE. TO REDUCE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE UNITS TO RAIN OR MOISTURE.

PREPARATION OF ANTENNA/RF ASSEMBLY FOR INSTALLATION

The fully assembled Antenna/RF Assembly is shown in Figure 3-8. A side view of the assembly is given in Figure 3-9 showing the elevation adjustment.

The antenna mounting bracket is designed so it can be installed on the antenna for vertical or horizontal polarization (antennas at each end of the link must have the same polarization). Also, several elevation tilt adjustment ranges are possible. This requirement may be different for each end of the link.

The standard 2 foot antenna is designed so that the Duplex RF Box can be mounted on the rear of the antenna. However, at some locations, it may be desirable to mount the antenna and RF Unit separately so that easy access is provided to the RF Unit for servicing. Special mounting kits are available for this purpose. See the reference drawing section of this manual.

Also, when optional 4 foot antennas are used, the RF Unit must be mounted separately.

ELEVATION TILT RANGE. The antenna mounting bracket is attached to the reflector using three reflector standoffs (or ears). The mounting kit contains a total of five ears (two extra ears); three short ears and two tall ears. The desired elevation tilt range determines which ears are used (Table 3-5 and Figures 3-10 through 3-14).

Table 3-5. Elevation Tilt Range

ELEVATION TILT RANGE	REMARKS
−15 to +24°	Use two tall ears at points A and B, short ear at C. Mount rightside up.
−24 to +15°	Use two tall ears at points A and B, short ear at C. Mount upside down.
−4 to +30°	Use the same length ears (all short) at points A, B, and C. Mount rightside up.
−30 to +4°	Use the same length ears (all short) at points A, B, and C. Mount upside down.

Note: Unless the Antenna/RF Assembly will be mounted rightside up, horizontal polarization as shown in Figure 3-8, install a weatherproof right angle adapter (not supplied) onto each F connector of the RF Units.

ANTENNA POLARIZATION. The placement of the ears (reflector standoffs) on the reflector in relation to the location of the RF Box mounting bolt locations determines the antenna polarization (horizontal or vertical).

Option A – Horizontal Polarization

For horizontal polarization, perform the following steps:

Step 1. Attach the corner ears as shown in Figure 3-10. Make sure the waveguide slot has the long dimension situated vertically as shown.

NOTE

Be sure that at poins A and B are of the correct length for the desired elevation tilt range in accordance with Table 3-5.

Step 2. Mount the bracket assembly to the ears as shown in Figure 3-11 using the hex head bolts and nuts (3 places).

Step 3. Mount the RF Unit on the reflector using screws at points D, E, F, and G with the connectors pointing down as shown in Figure 3-12.

Step 4. Connect one end of the short piece of flexguide to point H using four screws (#4-40 x 1/2″ long).

Step 5. Connect the other end of the flexguide to point I using four screws (#4-40 x 3/8″ long).

CAUTION

Be sure that O-rings are properly in place in each choke and O-ring flange.

Option B – Vertical Polarization

For vertical polarization, perform the following steps:

Step 1. Attach the corner ears as shown in Figure 3-15. Make sure the waveguide slot has the long dimension situated horizontally as shown.

NOTE

Be sure that ears at points A and B are of the correct length for the desired elevation tilt range in accordance with Table 3-5.

Step 2. Mount the bracket assembly to the ears as shown in Figure 3-16 using he hex head bolts and nuts (3 places).

Step 3. Mount the RF Unit on the reflector using screws at poins D, E, F, and G with the connectors pointing down as shown in Figure 3-17.

Step 4. Connect one end of the short piece of flexguide to point H using four screws (#4-40 x 1/2″ long).

Step 5. Connect the other end of the flexguide to point I using four screws (#4-40 x 3/8″ long).

CAUTION

Be sure that O-rings are properly in place in each choke and O-ring flange.

MOUNT THE OUTDOOR EQUIPMENT IN THEIR PREDETERMINED OUTDOOR LOCATIONS

MOUNTING OF ANTENNA/RF ASSEMBLY (DUPLEX SYSTEMS). At each end of the link, install the Antenna/RF Assemblies in their respective permanent locations as follows:

NOTES

1. If greater uptilt than downtilt is required, mount the assembly with the pole to the left of the antenna center (reference Table 3-3 and Figures 3-13 and 3-18).

2. If greater downtilt than uptilt is required, mount the assembly with the pole to the right of the antenna center; i.e., upside down (reference Figures 3-14 and 3-19).

Step 1. Clamp the Antenna/RF Assembly to a vertical mast (4 to 4.5″ O.D.) using the two larger U-bolts and associated hardware (supplied). If the mast O.D. is less than 4″, use the two smaller U-bolts (supplied).

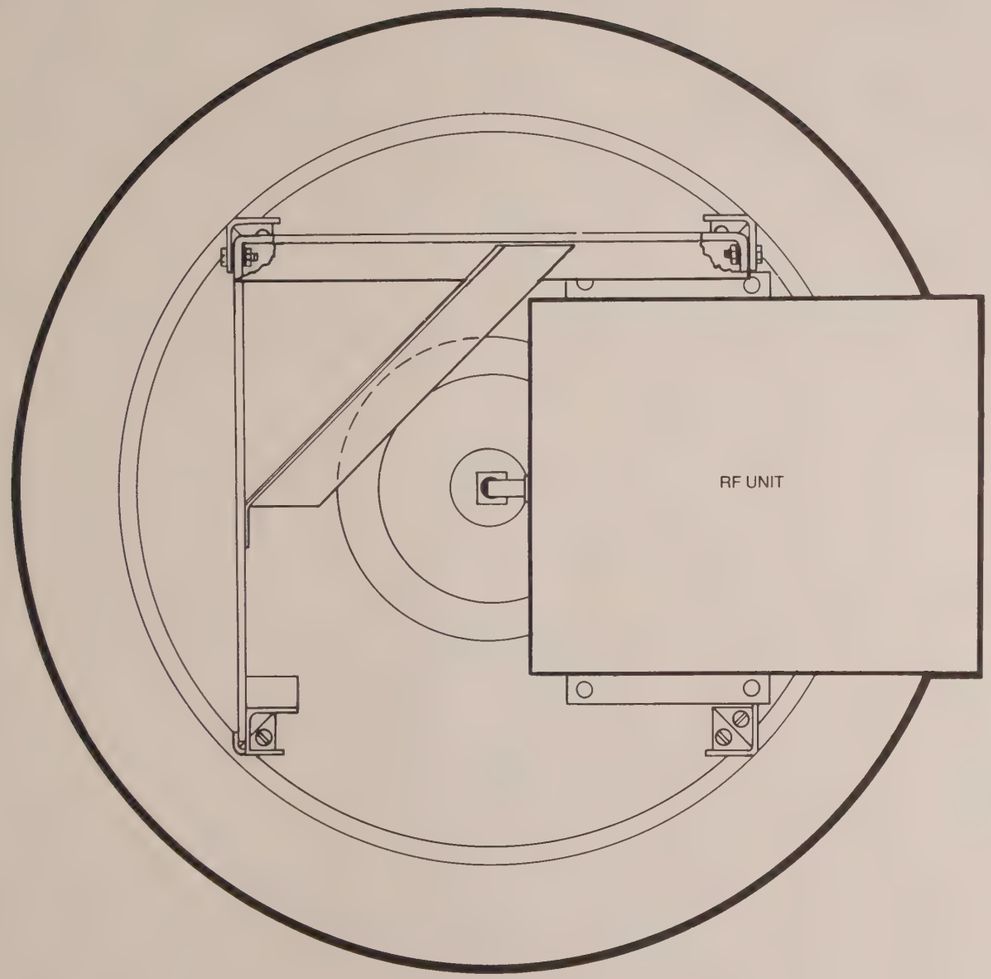


Figure 3-8. Fully Assembled RF/Antenna Assembly – Horizontal Polarization

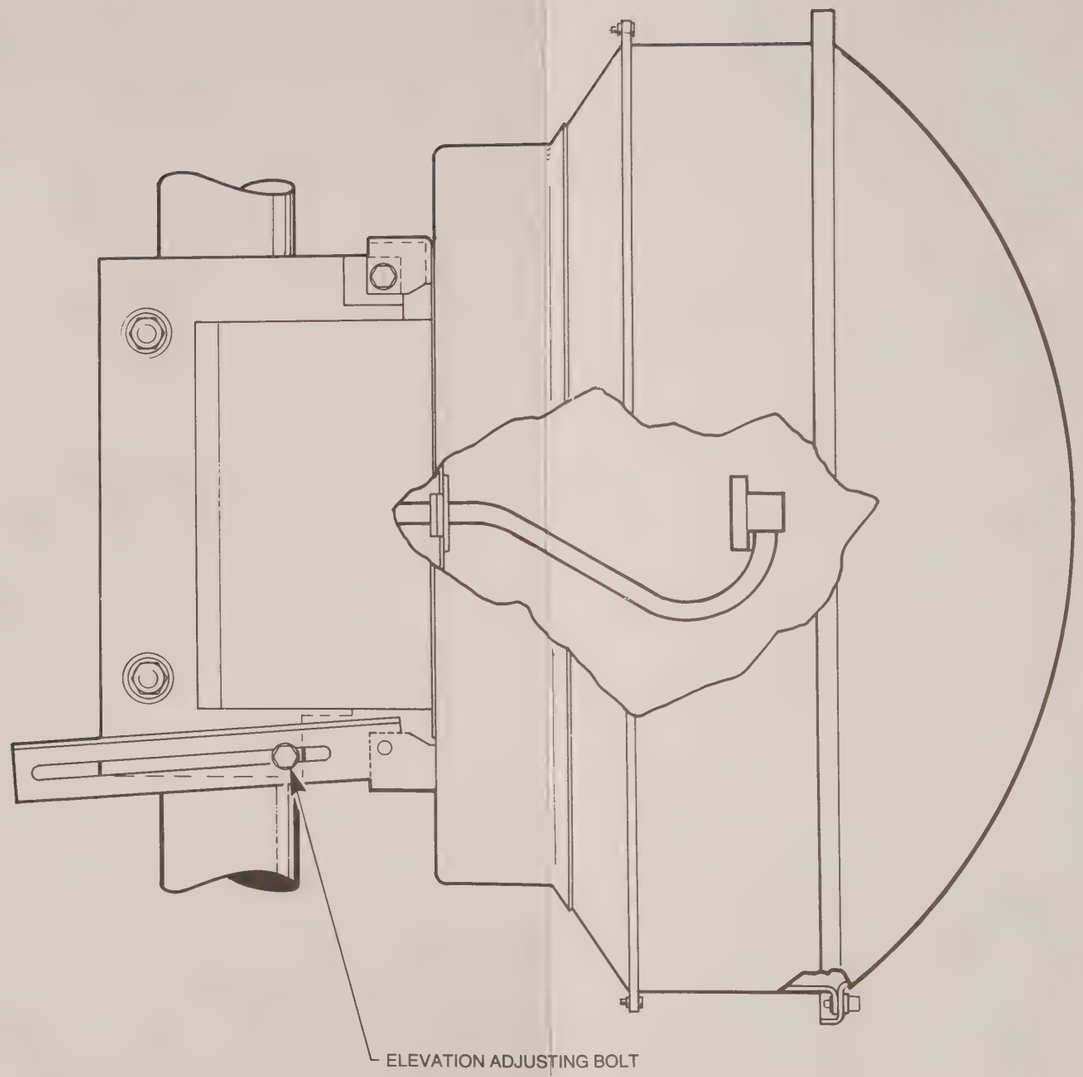


Figure 3-9. Side View Showing Elevation Adjustment Bolt

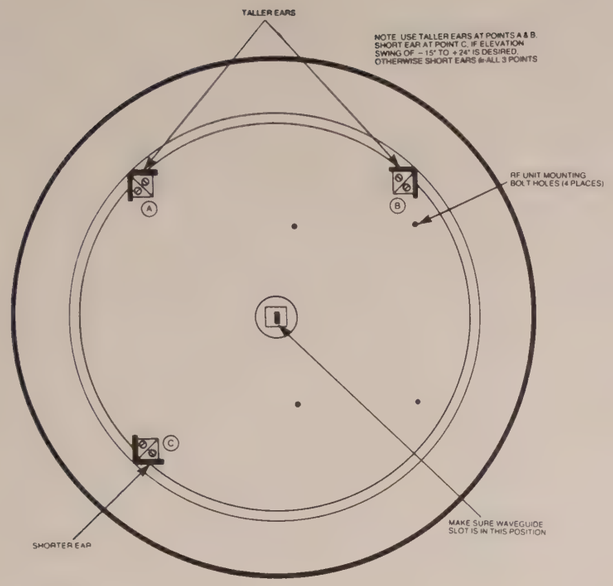

TALLER EARS
NOTE: USE TALLER EARS AT POINTS A & B. SHORT EAR AT POINT C. IF ELEVATION SWING OF −15° TO +24° IS DESIRED. OTHERWISE SHORT EARS @ ALL 3 POINTS
RF UNIT MOUNTING BOLT HOLES (4 PLACES)
A
B
C
SHORTER EAR
MAKE SURE WAVEGUIDE SLOT IS IN THIS POSITION

Figure 3-10. Corner Ear Installation For Horizontal Polarization

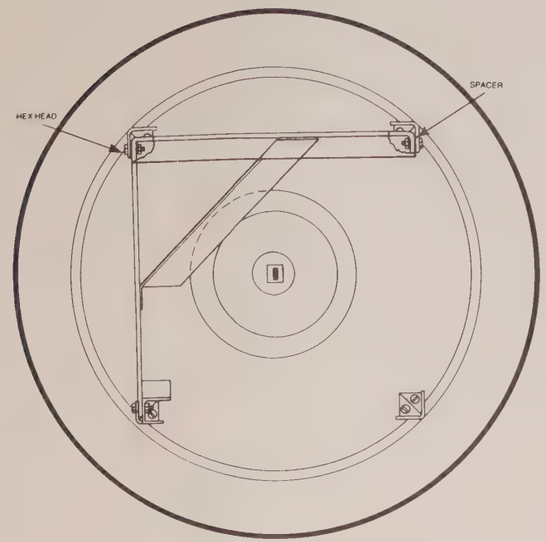


Figure 3-11. Mounting Bracket Installation – Horizontal Polarization

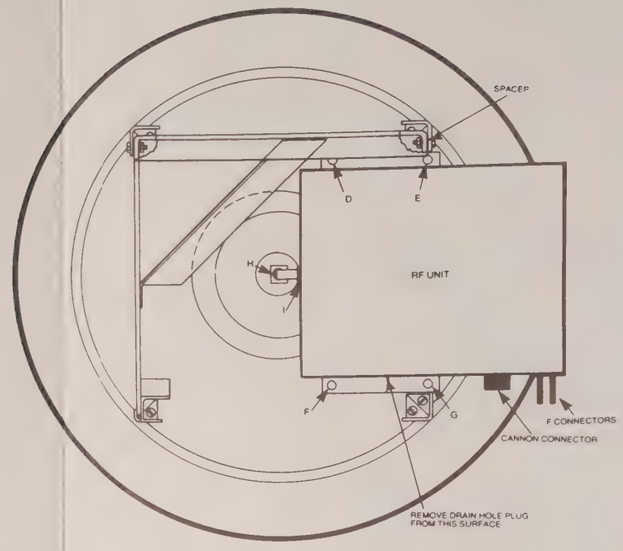


Figure 3-12. Fully Assembled RF/Antenna Assembly – Horizontal Polarization

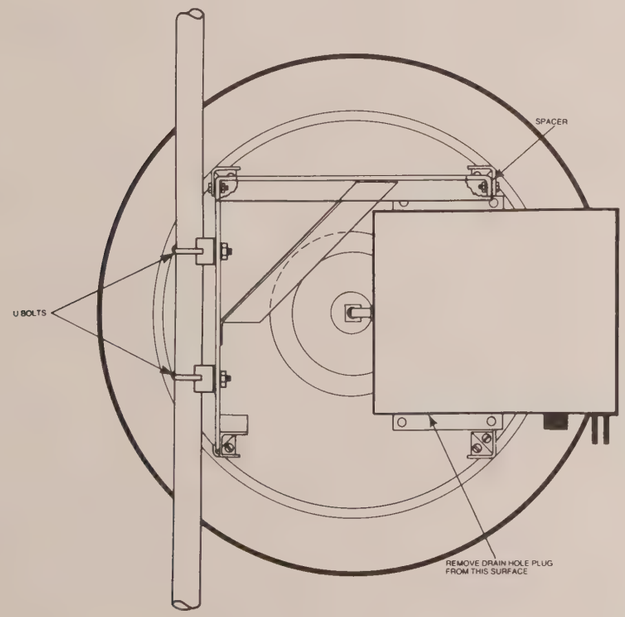


Figure 3-13. Horizontal Polarization – Mount For Elevation Tilt −15° to +24° Range or −4° to +30° Range

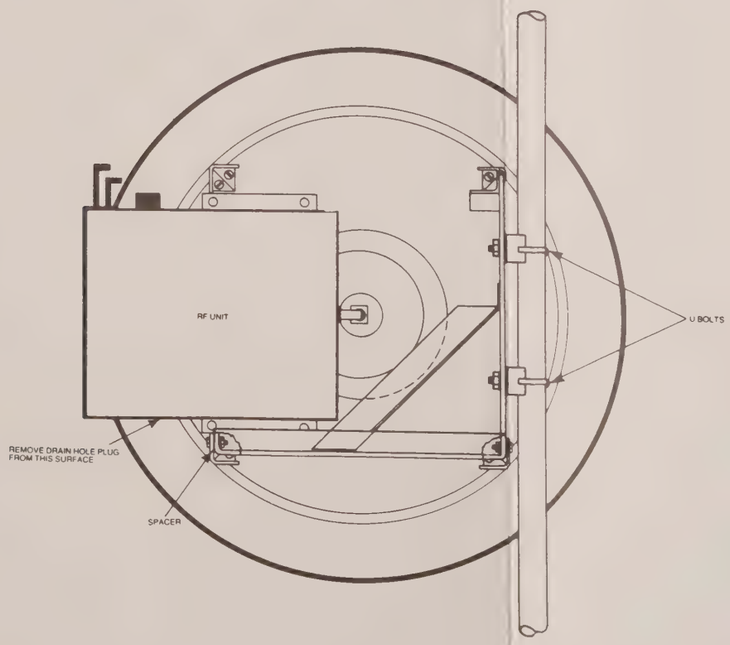


Figure 3-14. Horizontal Polarization – Mount For Elevation Tilt −24° to +15° Range or −30° to +4° Range

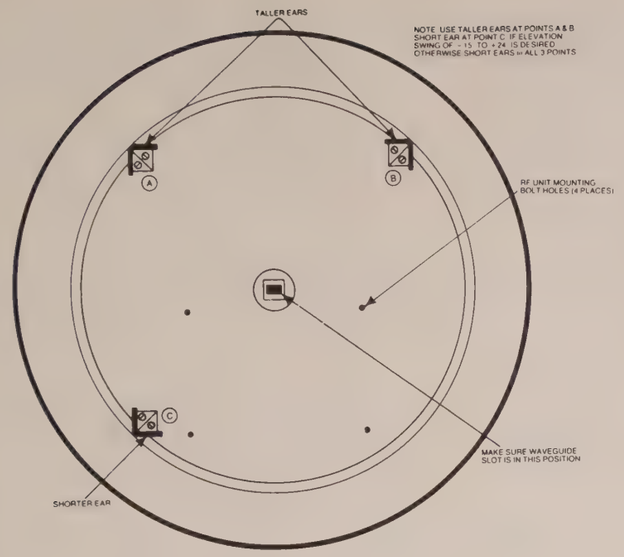

TALLER EARS
NOTE: USE TALLER EARS AT POINTS A & B SHORT EAR AT POINT C IF ELEVATION SWING OF -15 TO +24 IS DESIRED. OTHERWISE SHORT EARS IN ALL 3 POINTS
RF UNIT MOUNTING BOLT HOLES (4 PLACES)
A
B
C
MAKE SURE WAVEGUIDE SLOT IS IN THIS POSITION
SHORTER EAR

Figure 3-15. Corner Ear Installation For Vertical Polarization

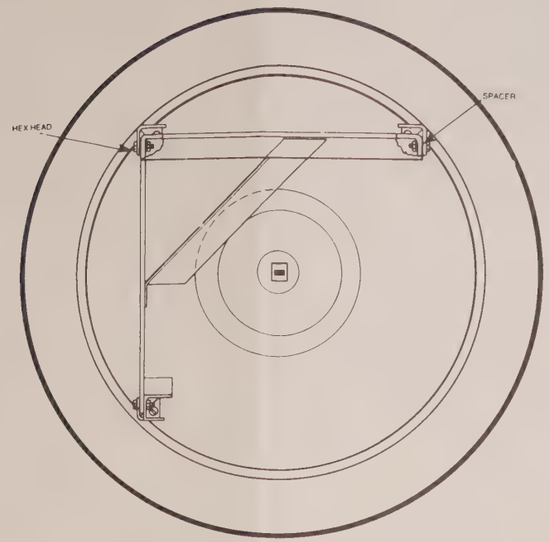


Figure 3-16. Mounting Bracket Installation – Vertical Polarization

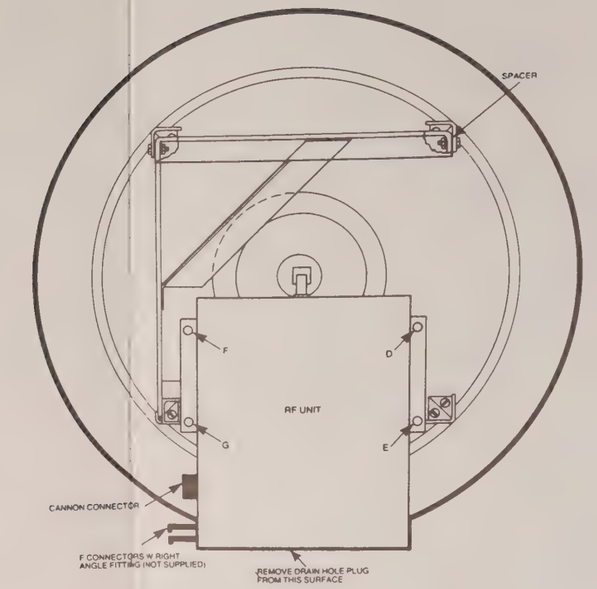


Figure 3-17. Fully Assembled RF/Antenna Assembly – Vertical Polarization

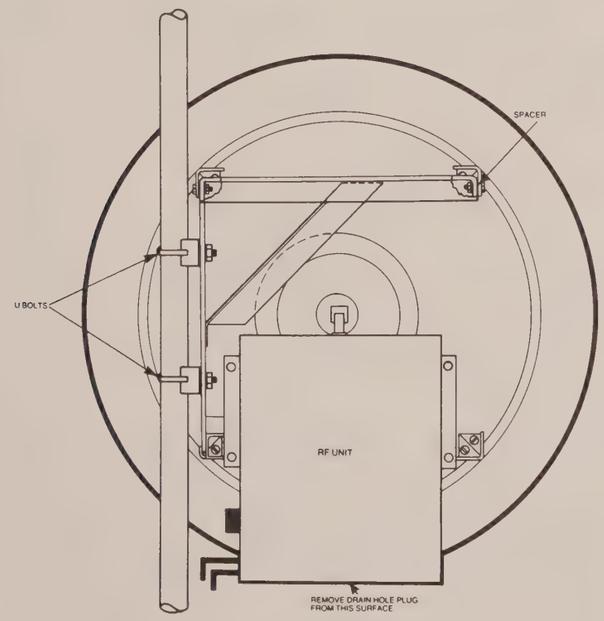


Figure 3-18. Vertical Polarization – Mount For Elevation Tilt −15° to +24° Range or −4° to +30° Range

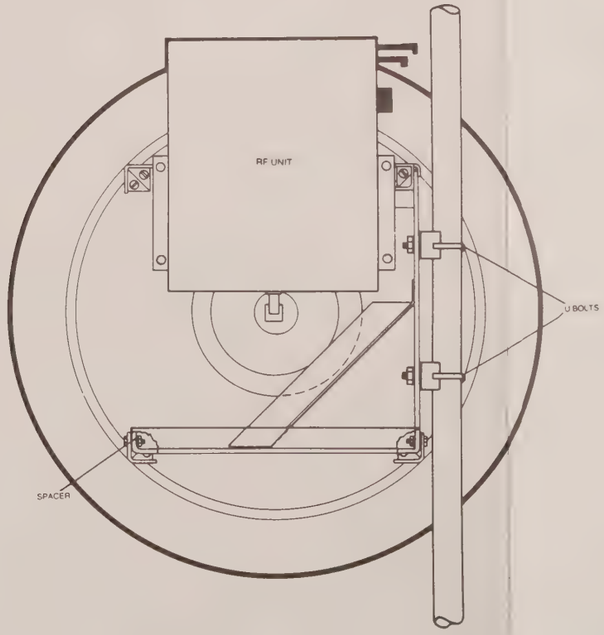


Figure 3-19. Vertical Polarization – Mount For Elevation Tilt −24° to +15° Range or −30° to +4° Range

Step 2. Use a safety collar (not supplied) installed below the bottom U-bolt to hold the assembly in place until the antenna alignment is completed.

Step 3. The RF Unit has drain plugs on each of four surfaces. Remove only the drain plug from the bottom surface (as mounted).

CAUTION

Be sure to mount the assembly in accordance with precautionary labels to prevent the entrance of moisture.

MOUNTING OF MULTIPLEX RF ASSEMBLIES. Up to four duplex systems can be multiplexed onto a single antenna using Stacking/Combiner Kits as shown in Figures 3-20 and 3-21. The Stacking/Combiner Kits provide mounting and waveguide interconnection facilities for up to four weather-resistant RF Units on a common mounting channel. Three U-bolts are provided for mounting on a vertical mast (4 to 4.5″ O.D.). A three foot length of flexible WR-42 waveguide is provided for connection to the antenna.

OTHER MOUNTING CONFIGURATIONS. A variety of Antenna/RF Assembly mounts are possible depending on the nature of the site. Some typical mounts are shown in Figures 3-22 through 3-25.

When the antenna and RF Unit are mounted separately, a short length of flexible WR-42 waveguide is used for RF signal connection between the RF Unit and the antenna. However, at installations subject to severe weather environments, the use of pressurized EW-220 or EWP-220 elliptical waveguide is recommended for connection of RF signals from the RF Box to the antenna in lengths not to exceed 100 feet (30 meters).

Waveguide runs of 10 feet or longer should be pressurized to prevent electrical performance degradation due to moisture condensation. Several types of pressurization systems (static or dynamic) are available for this purpose. A typical pressurized waveguide system is shown in Figure 3-26. All pressurization systems should be inspected periodically to ensure that they are operating properly.

CONNECT RF AND POWER INTERCONNECTION CABLES TO RF UNITS

RF and power interconnection cable connections between the indoor Transmitter and Receiver Baseband Units and the outdoor Antenna/RF Assembly are shown in Figures 3-2 through 3-4.

Step 1. Connect the coax cable from the Transmitter Baseband Unit to the BB IN Type F connector on the RF Unit.

Step 2. Connect the coax cable from the Receiver Baseband Unit to the IF OUT Type F connector on the RF Unit.

Step 3. Connect the power cable to the POWER connector on the RF Unit.

Step 4. Apply RTV sealing compound (not supplied) to all exposed connectors.

NOTE

Verify that center conductor is protruding about 1/8″ to assure good contact.

CONNECT RF AND POWER INTERCONNECTION CABLES TO INDOOR UNITS

Coax and power interconnection cable connections to the indoor units are shown in Figures 3-2 through 3-4.

NOTES

1. The braid on the power cable must be grounded at both ends of the cable; i.e., one end on the Cannon connector and the other at the Baseband Unit.

2. If stranded wire is used, make sure no loose strands are shorted to case.

ELECTRICAL INTERFACE AND POWER CONNECTIONS

All electrical interface and power connections are made on the rear panels of the Transmitter/Receiver Baseband Units (Figures 3-27 and 3-28).

ALARM INTERFACE CONNECTIONS. External alarm interface connections are available for customer use on Transmitter and Receiver Baseband Units.

The Transmitter Baseband Unit provides a Form C, dry relay contact summary alarm under the following conditions; TX source (Gunn) current too high or too low, or prime power failure. The Receiver Baseband Unit provides a Form C, dry relay contact summary alarm under the following conditions; loss of carrier, or prime power failure. Summary alarm connections for Transmitter and Receiver Baseband Units are available at terminal strip TB2 located on the rear panel of each unit.

VIDEO/BASEBAND INPUT/OUTPUT CONNECTIONS. Video/baseband interface connections are made to coaxial connectors located on the rear panels of the Transmitter and Receiver Baseband Units.

Video/baseband signals:

1. Transmitter inputs: standard 1V P-P, 75 ohm impedance. The video/baseband inputs are terminated into 75 ohms by the Transmitter Baseband Unit.

2. Receiver outputs: standard 1V P-P, 75 ohm output impedance.

AUDIO/DATA INPUT/OUTPUT CONNECTIONS. Audio/data interface connections are made to push-on type connectors located on the rear panels of the Transmitter and Receiver Baseband Units.

Audio signals:

1. Transmitter input: +0 dBm (2.2V P-P), 600 ohm balanced input. Connect ground to the common (center) terminal and connect audio wires to the line terminals (on either side of the common terminal). If an unbalanced audio is provided, connect the signal lead to one of the line terminals and connect the ground lead to the common (center) terminal and the other line terminal.

2. Receiver output: +9 dBm (6.2V P-P), 600 ohm balanced output.

PRIMARY POWER CONNECTIONS. The 23 GHz systems operate from 115/230 Vac line power or from −24 or −48 Vdc power sources, which must be specified for each system. Primary power connections are made to the indoor Transmitter and Receiver Baseband Units (all systems).

The outdoor RF Units are powered by the indoor units via the power interconnection cables. When primary power connections are made to the indoor units, the outdoor RF Units are energized.

Since 23 GHz systems are designed for continuous, unattended operation, there are no power switches. Once primary power connections are made, the system is operational.

Option A – DC Powered Systems

DC power connections are made to terminal strips located on the rear panels of the indoor units.

Carefully observe conductor polarity and cross section requirements (typically 12 or 14 AWG stranded cable) before making primary power connections.

Option B – AC Powered Systems

AC powered systems will operate from 115 or 230 Vac mains. Be sure the mains selecting card is positioned to the correct voltage and that the correct fuse is installed (Figures 3-29 and 3-30).

For 110/220 Vac use 1A and for 220/240 Vac use 0.5A fuse.

Note that use of 100 Vac mains selecting card orientation yields identical performance to 120 Vac orientation. Also, 220 Vac card orientation yields identical performance to 240 Vac orientation.

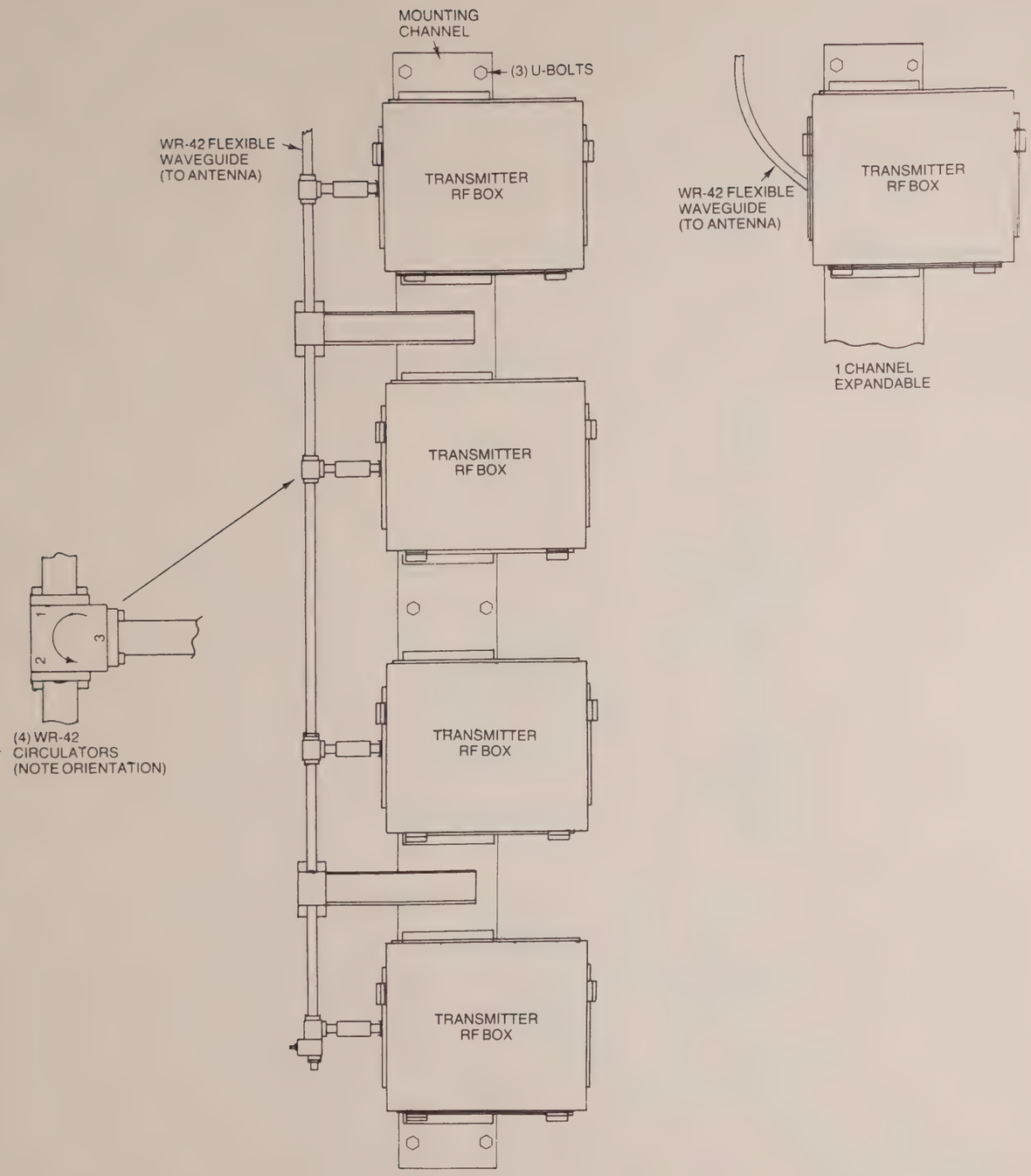


Figure 3-20. Stacking/Combiner Kit – 4 TX Channels

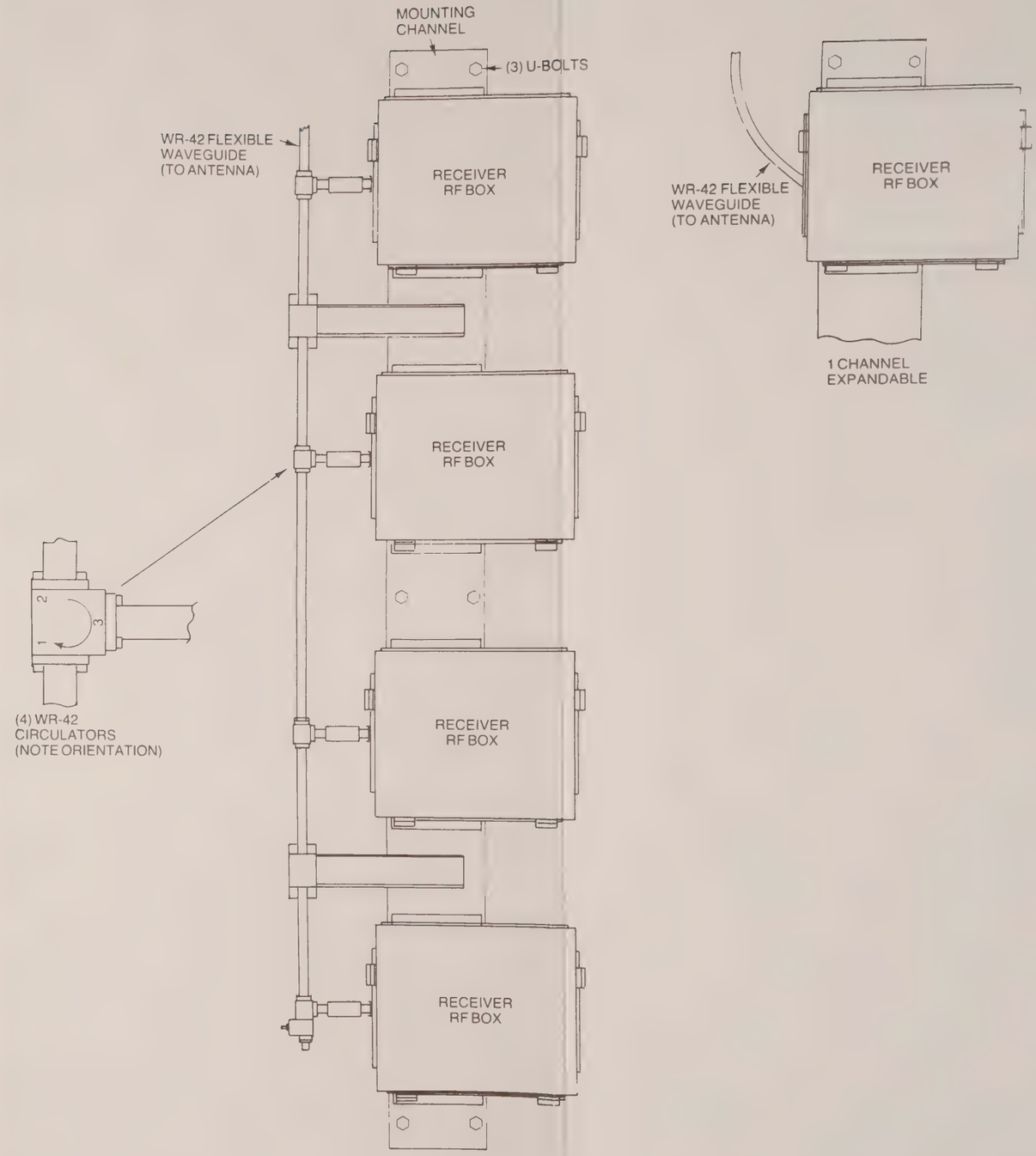


Figure 3-21. Stacking/Combiner Kit – 4 RX Channels

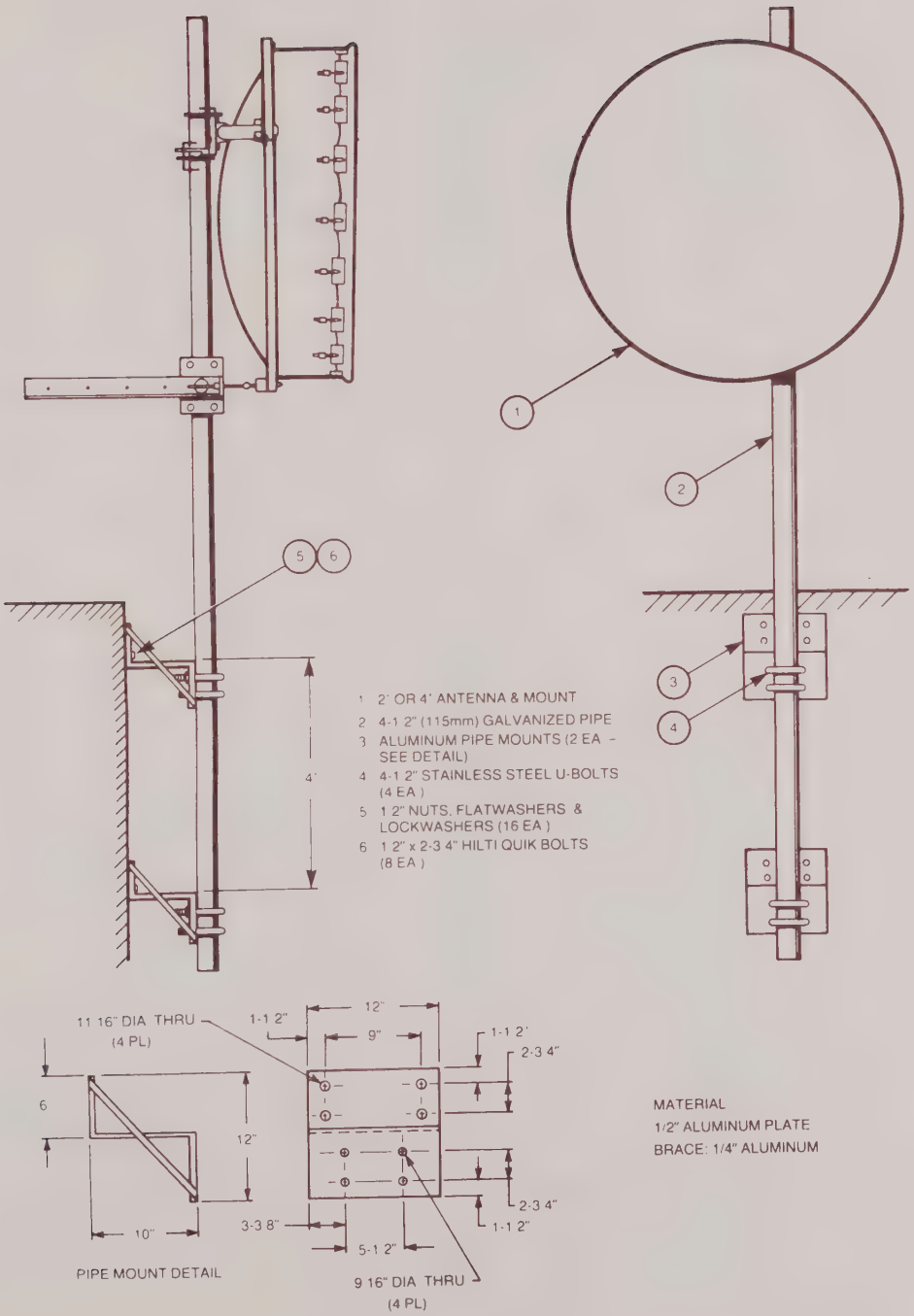


Figure 3-22. Typical Wall Mount Installation

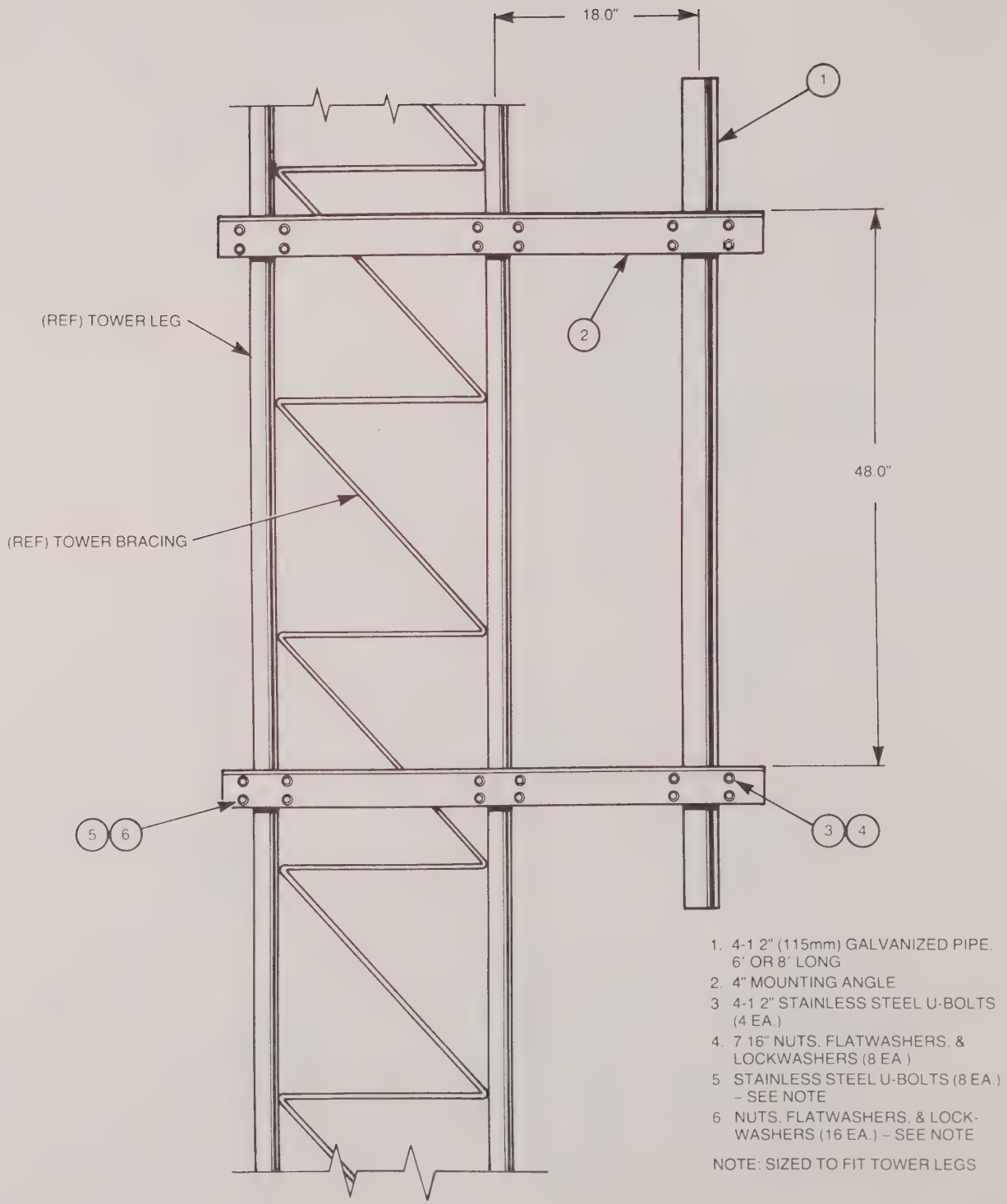

18.0"
1
(REF) TOWER LEG
2
48.0"
(REF) TOWER BRACING
5
6
3
4
1. 4-1 2" (115mm) GALVANIZED PIPE, 6' OR 8' LONG
2. 4" MOUNTING ANGLE
3 4-1 2" STAINLESS STEEL U-BOLTS (4 EA.)
4. 7 16" NUTS, FLATWASHERS, & LOCKWASHERS (8 EA)
5 STAINLESS STEEL U-BOLTS (8 EA.) - SEE NOTE
6 NUTS, FLATWASHERS, & LOCK-WASHERS (16 EA.) - SEE NOTE
NOTE: SIZED TO FIT TOWER LEGS

Figure 3-23. Typical Side Mount Installation

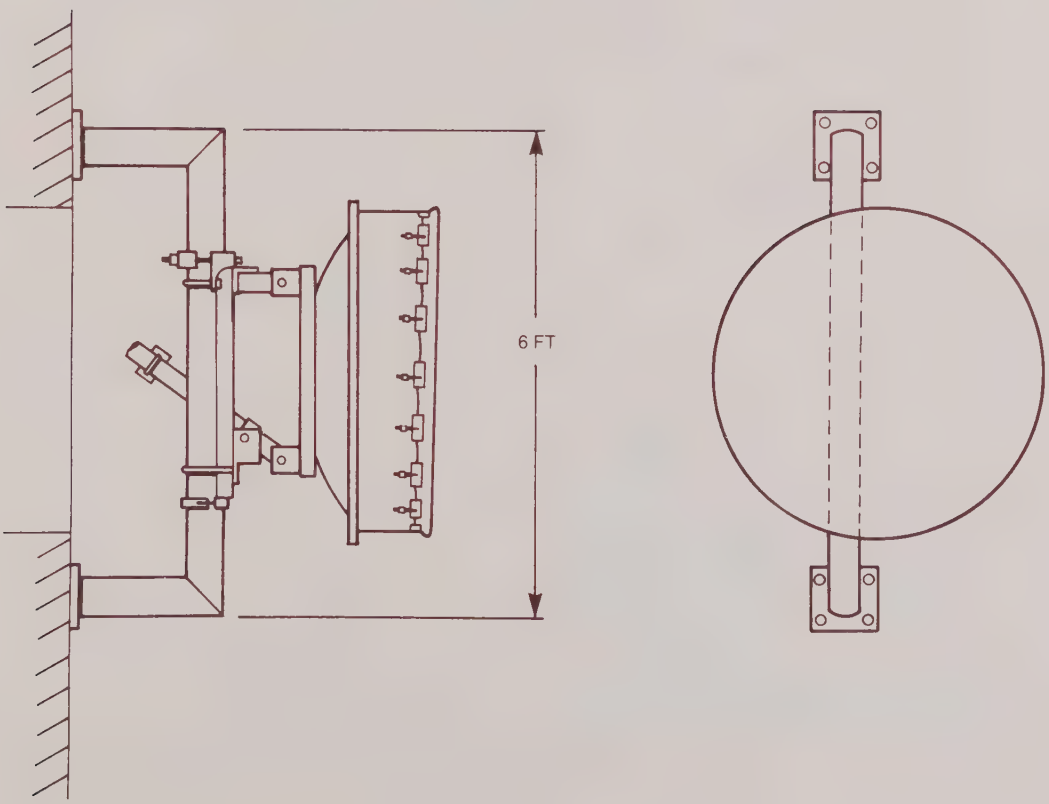


Figure 3-24. Typical Window Mount Installation

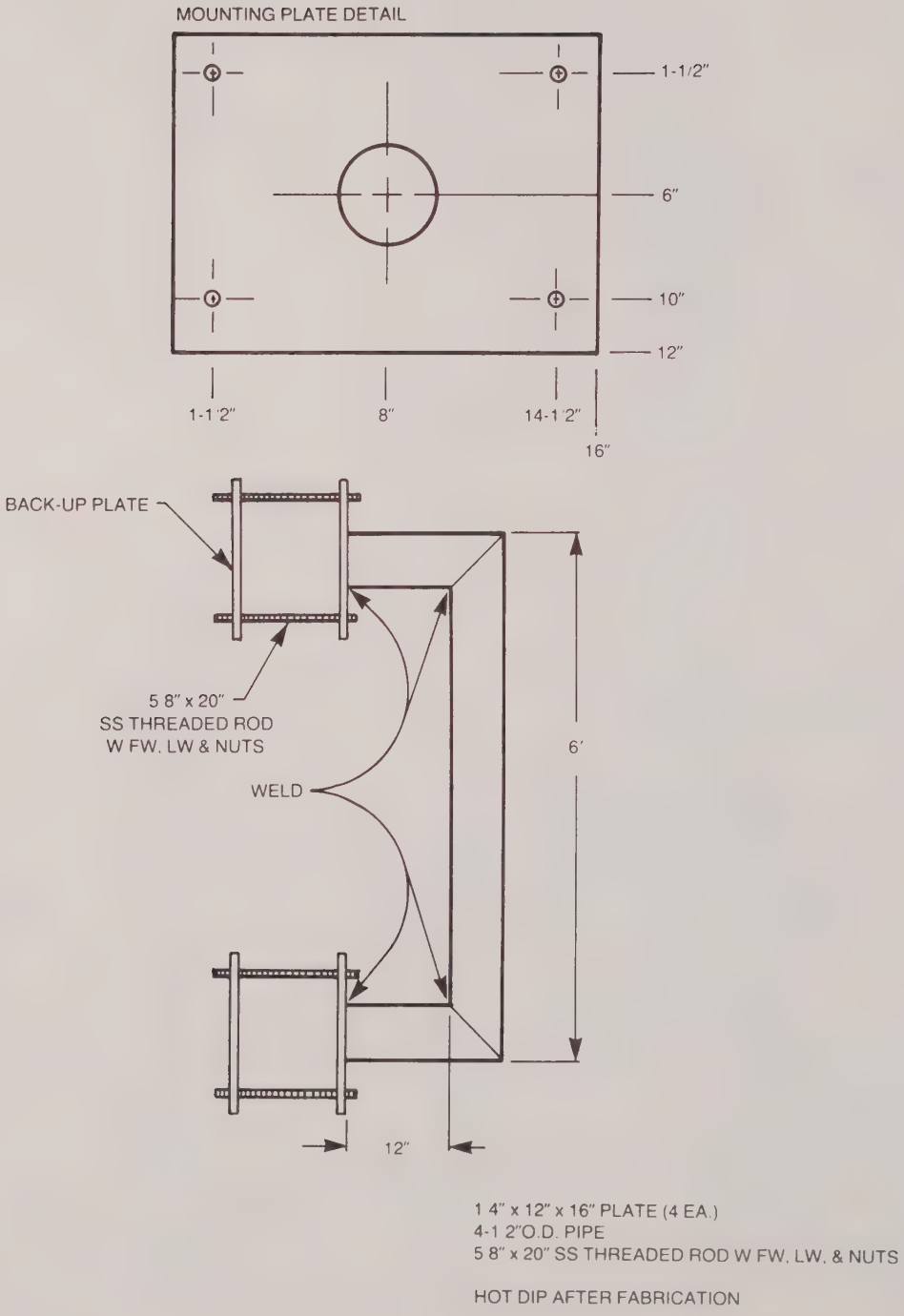


Figure 3-25. Typical Window Mount Bracket Detail

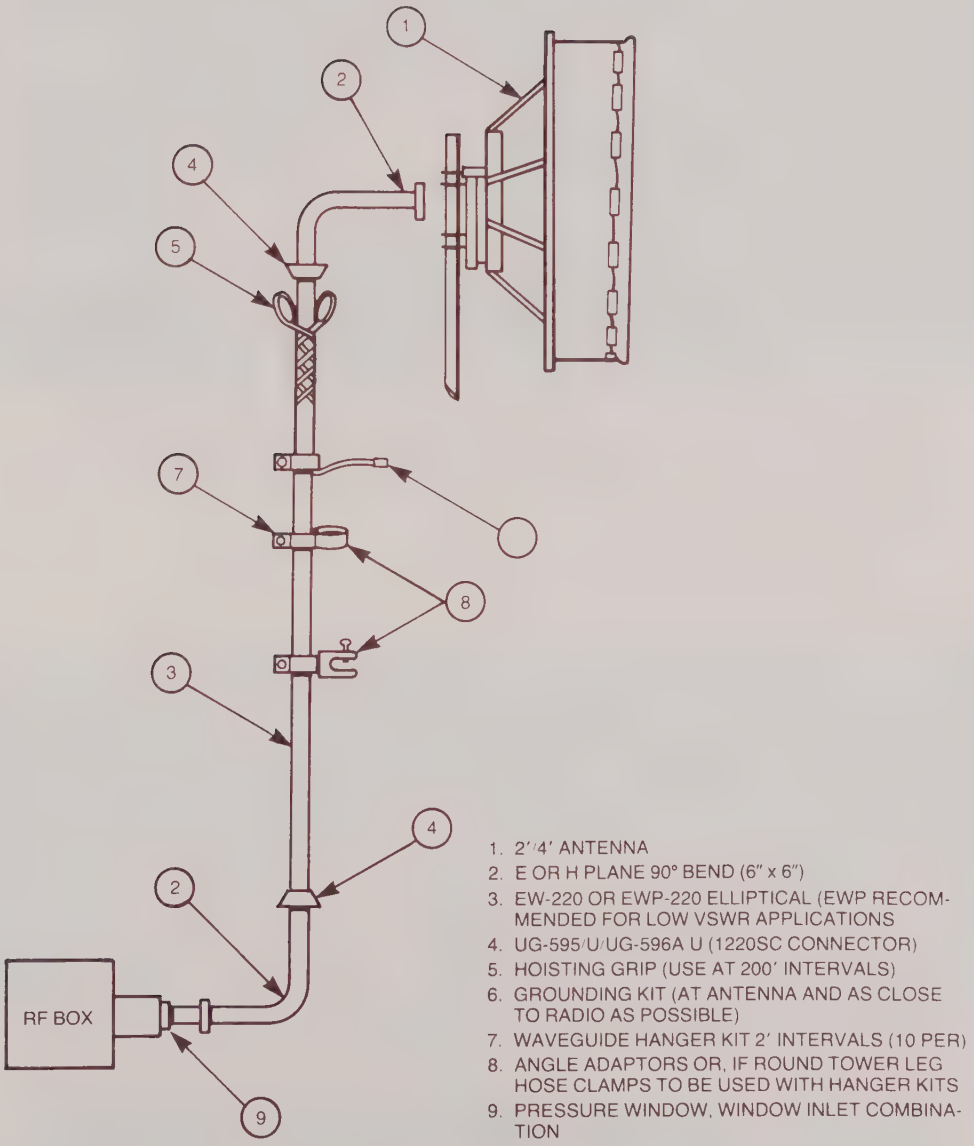

1
2
4
5
7
8
3
4
2
RF BOX
9
1. 2′/4′ ANTENNA
2. E OR H PLANE 90° BEND (6″ x 6″)
3. EW-220 OR EWP-220 ELLIPTICAL (EWP RECOMMENDED FOR LOW VSWR APPLICATIONS
4. UG-595/U/UG-596A U (1220SC CONNECTOR)
5. HOISTING GRIP (USE AT 200′ INTERVALS)
6. GROUNDING KIT (AT ANTENNA AND AS CLOSE TO RADIO AS POSSIBLE)
7. WAVEGUIDE HANGER KIT 2′ INTERVALS (10 PER)
8. ANGLE ADAPTORS OR, IF ROUND TOWER LEG HOSE CLAMPS TO BE USED WITH HANGER KITS
9. PRESSURE WINDOW, WINDOW INLET COMBINATION

Figure 3-26. Typical Elliptical Waveguide Installation

Figure 3-27. Transmitter Baseband Unit – Rear View

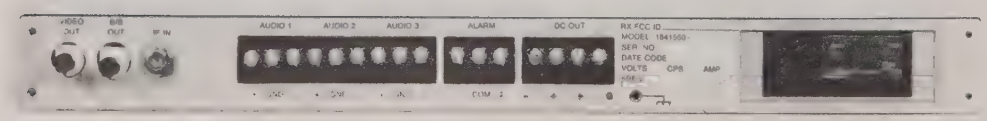


Figure 3-28. Receiver Baseband Unit – Rear View

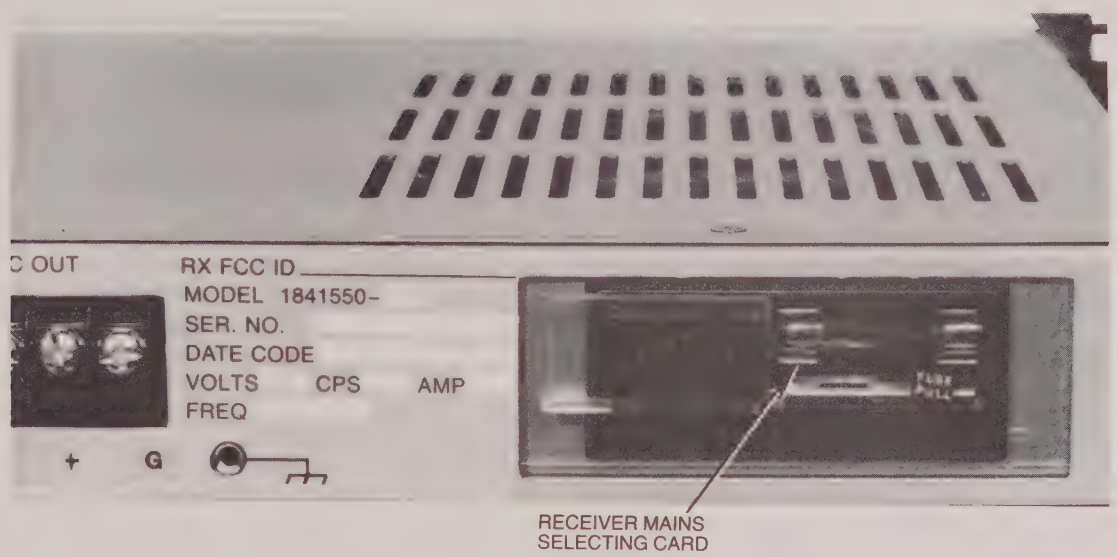


Figure 3-29. Mains Selecting Card – Location on Rear of Chassis

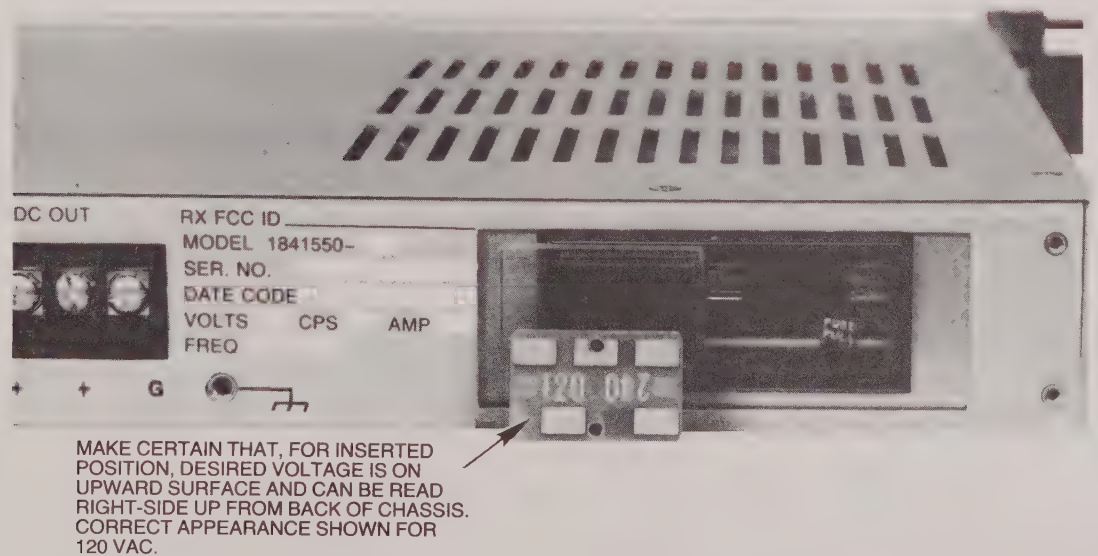

DC OUT
RX FCC ID
MODEL 1841550-
SER. NO.
DATE CODE
VOLTS CPS AMP
FREQ
+ + G
120 OHZ
MAKE CERTAIN THAT, FOR INSERTED POSITION, DESIRED VOLTAGE IS ON UPWARD SURFACE AND CAN BE READ RIGHT-SIDE UP FROM BACK OF CHASSIS. CORRECT APPEARANCE SHOWN FOR 120 VAC.

Figure 3-30. Mains Selecting Card – Shown Oriented for 120 Vac Operation

SECTION 4
ANTENNA ALIGNMENT AND FINE TUNING

ANTENNA ALIGNMENT

It is assumed that prior to installation, proper line-of-sight (LOS) has been assured.

PREPARATION

Step 1. Plug in the Transmitter/Receiver Baseband Units at each end of the link. The Baseband Units will now provide power for operation of the outdoor RF/Antenna Units so that RF signals are available for alignment.

Step 2. Appoint a supervisor to direct alignment operations and establish a communications link between the supervisor and sites at both ends of the link using telephones or two-way radio.

ALIGNMENT. Alignment of the transmitting and receiving antennas is a simple procedure but requires that they be pointed toward each other in both azimuth and elevation with a reasonable degree of accuracy. Since the antenna beamwidth is 1.8° (2 foot dish), misalignment of the antennas by 0.9° means that approximately only one-half of the signal power will be received.

Step 1. *Visually Point Antennas.* The easiest method of pointing the antennas toward each other is by visually aligning them. This method is preferred for short distances when both sites are in view of each other. However, for longer paths, where there are no large easily identifiable landmarks on the horizon for visual reference, or if atmospheric conditions limit visibility during installation, then topographical maps must be used to determine antenna pointing angles. Details on this procedure, if found necessary, are provided later in this section.

Step 2. *Connection to AGC Voltage Readout.* Disconnect coax from IF OUT connector on Receiver RF Unit(s). The center conductor of the RF Box F connector has the AGC voltage on it. Use a digital voltmeter (DVM) on the 10V scale to measure this voltage during Step 3. Never insert DVM probe into connector, make a test cable and attach to DVM.

A typical AGC voltage versus received carrier level (RCL) graph is shown in Figure 4-1. Refer to AGC vs RCL measurements in factory test data supplied with each unit.

Step 3. *Alignment.* This operation requires a person at each antenna communicating to the supervisor by telephone or walkie-talkie.

At the first site, sweep the path by very slowly turning the RF/Antenna from left to right. The antenna pattern has a main lobe that provides the greatest gain. Immediately on either side of the main lobe, a sharp drop in signal strength occurs and then a slight increase in signal strength occurs. This increase is caused by the sidelobes. Peak the AGC voltage readings on the DVM until the maximum reading is obtained (this corresponds to the point of maximum signal strength) and secure the RF/Antenna Assembly in this position.

Step 4. Next, change the tilt of the antenna and further peak the AGC reading. The same antenna pattern considerations noted above also apply here.

Step 5. Next, align the other antenna using the same procedures as performed at the first site while monitoring the AGC voltage readings on the DVM.

Step 6. Repeat Steps 3 through 5 until the AGC value at the Receiver is peaked (refer to factory test data).

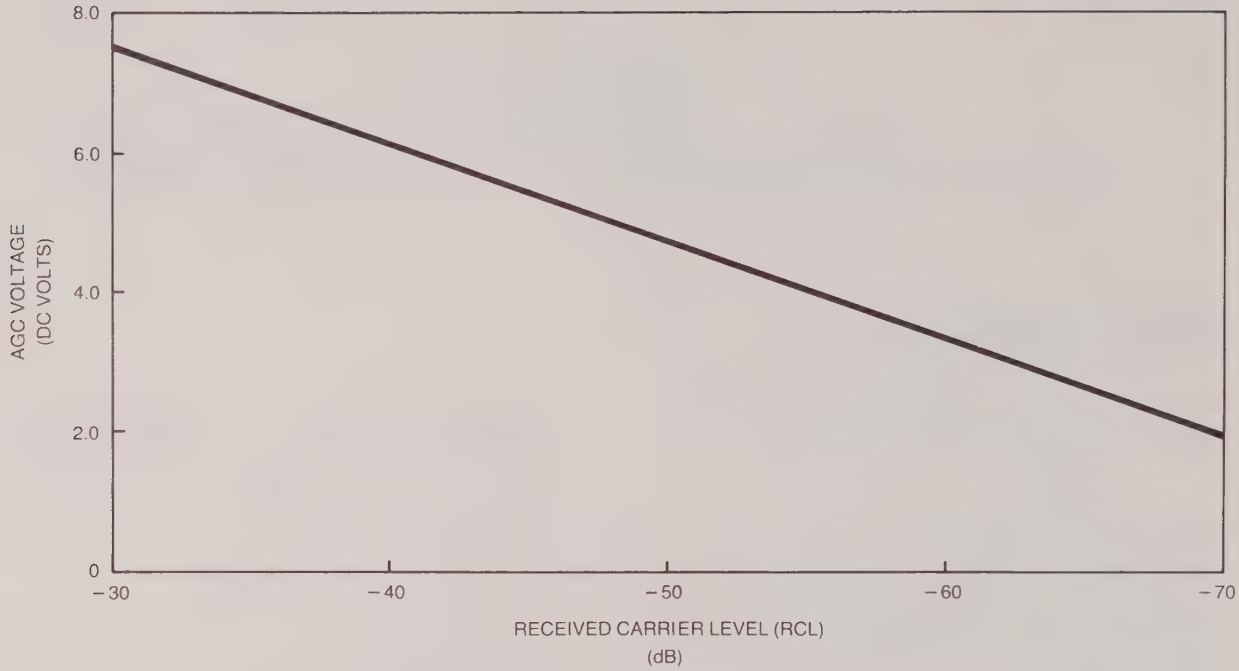


Figure 4-1. AGC vs RCL Graph

INITIATING ANTENNA POINTING AND ALIGNMENT USING TOPOGRAPHICAL MAPS

The two antenna pointing angles that must be determined, are azimuth and elevation. Azimuth is the angle in the horizontal plane with respect to true north. The antenna can be pointed to the correct azimuth angle by turning it on the mounting pole. Elevation is the angle in the vertical plane with respect to the horizontal plane. The elevation angle of the antenna is varied by adjusting the length of the elevation adjustment rod via the bolt at the lower end of the rod (Figure 3-9).

To determine the azimuth angle between the transmitting and receiving antennas, draw a straight line on the map connecting both sites. If possible, locate a distinct landmark which can be used for a visual reference to align the antennas. If this landmark does not lie directly on this straight line, draw another straight line to the landmark. Using a protractor, measure the angle between the two lines to determine the offset angle. Align the antenna using this offset angle.

If no distinct landmarks are available, a magnetic compass may be used for antenna alignment. First, measure the angle between true north and the straight line drawn on the map connecting both sites. Convert the azimuth to magnetic north using the local declination angle. The difference between true north and magnetic north as follows:

a. If magnetic north is to the west of true north, add local declination to the azimuth.

b. If magnetic north is to east of true north, subtract local declination from the azimuth.

The local declination angle can be obtained from topographical maps.

An example of this method is shown in Figure 4-2 for a site located in Boston, Massachusetts area where the local declination is 14°W. Note that when using

the compass to align the antenna in azimuth, care should be taken not to introduce errors because of nearby metal objects.

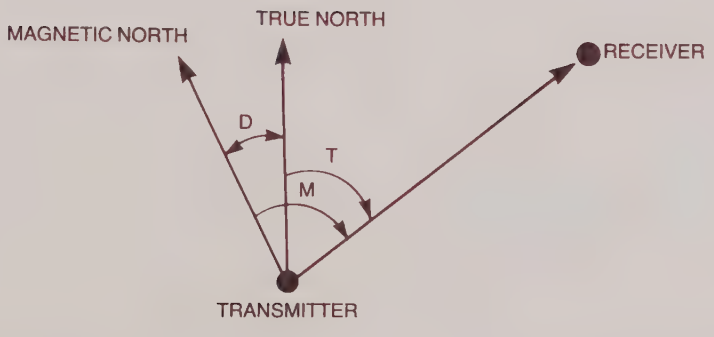
If visual alignment is not feasible, then the elevation angle must be calculated to align the antenna. The elevation angle may be calculated by taking the arctangent of the ratio of the difference in height of the two antennas to the distance between antennas. (Note: Height and distance must be in the same units; i.e., feet or meters). The difference in antenna heights can be determined from the mean sea level (MSL) heights of the two antennas and the distance can be measured on the topographical map using the appropriate scale. An example of an elevation angle calculation is shown in Figure 4-3. In this example, the transmitting antenna located on the building would be depressed by 2.3° from the horizontal to align the antenna in elevation.

FINAL NOTES

Once the equipment is fully installed, it is advisable to make measurements of key voltage and power values during a clear day so that a working link reference is readily available if the need for troubleshooting (Section 6) should ever arise.

The following list gives examples of a few key measurements if the proper test equipment is available.

1. AGC Voltage
   a. At Receiver front panel meter (meter is not calibrated in volts).
   b. At coax center conductor at Receiver Baseband chassis F connector (IF IN – Figure 3-28).
2. Note Transmitter source current (Gunn) meter reading on the Transmitter Baseband Unit.
3. Record these readings in a log book for future reference.



FORMULA: M = T + D
WHERE: T = AZIMUTH ANGLE FROM TRUE NORTH
D = DECLINATION ANGLE (FOR YOUR AREA)
M = AZIMUTH ANGLE FROM MAGNETIC NORTH

EXAMPLE: (FOR BOSTON, MA AREA)
T = 42°
D = 14°
M = 42° + 14°
= 56°

Figure 4-2. Azimuth (Magnetic Heading) Calculations

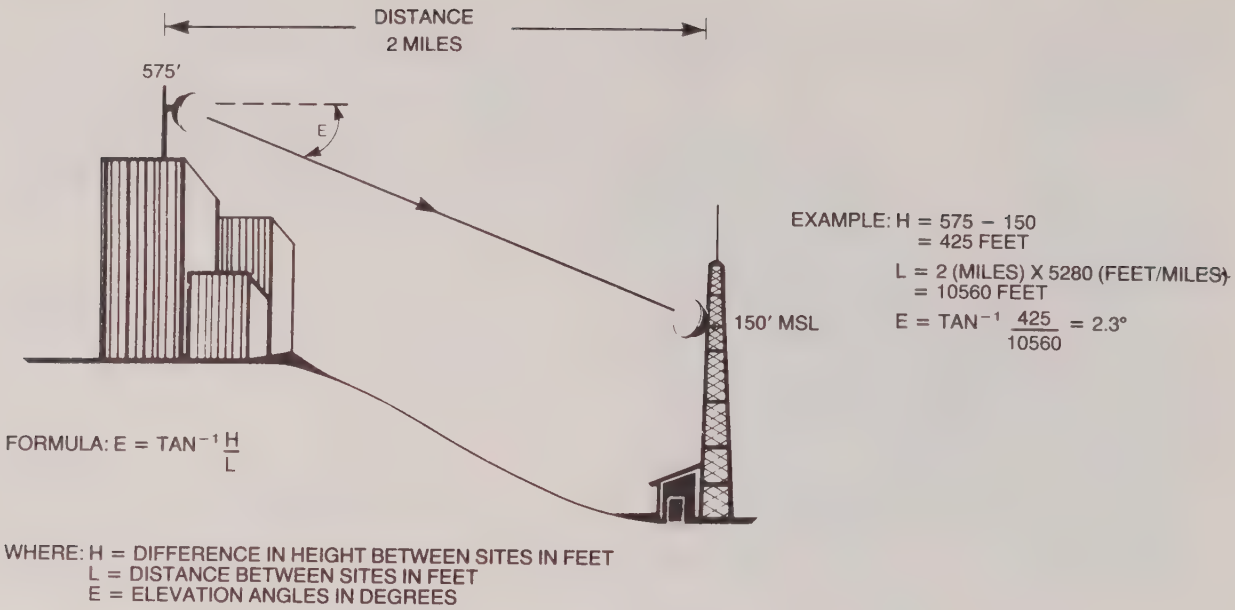

DISTANCE
2 MILES
575′
E
150′ MSL
EXAMPLE: H = 575 – 150
= 425 FEET
L = 2 (MILES) X 5280 (FEET/MILES)
= 10560 FEET
E = TAN⁻¹ 425/10560 = 2.3°
FORMULA: E = TAN⁻¹ H/L
WHERE: H = DIFFERENCE IN HEIGHT BETWEEN SITES IN FEET
L = DISTANCE BETWEEN SITES IN FEET
E = ELEVATION ANGLES IN DEGREES

Figure 4-3. Elevation Calculations

SECTION 5
OPERATING INSTRUCTIONS

SCOPE

After the 23 GHz System units have been installed in their permanent locations and the antennas have been aligned, the system is ready for operation. The system can now be used to transmit video, audio or data signals from the Transmitter site to the Receiver site. All system interface connections are made at the rear of the Transmitter and Receiver Baseband Units.

OPERATING CONTROLS AND INDICATORS

All operating controls and indicators for the 23 GHz System are located on the Transmitter and Receiver Baseband Units as listed in Tables 5-1 and 5-2.

Figures 5-1 through 5-4 show the front and rear panels of the Transmitter and Receiver Baseband Units.

CAUTION

To reduce the risk of electric shock, do not remove cover. No user serviceable parts inside. Refer servicing to qualified service personnel.

ALARMS

Figures 5-2 and 5-4 show the location and access to the alarms summarized in Table 5-3.

Table 5-1. Transmitter Baseband Unit – Controls and Indicators (Figure 5-1)

CONTROL OR INDICATOR	MARKING	FUNCTION
FRONT PANEL		
LED (Green)	POWER	Lights when power supply is operational.
LED (Green)	GUNN CURRENT	ON when current to Transmitter Gunn is within acceptable limits.
METER		Provides indication of Transmitter Source (Gunn) current.
REAR PANEL		
Fuse (1A for 100/120 Vac; 0.5A for 220/240 Vac)	FUSE-PULL	Fuse provides overload protection for Transmitter subsystem. Pull to remove fuse.

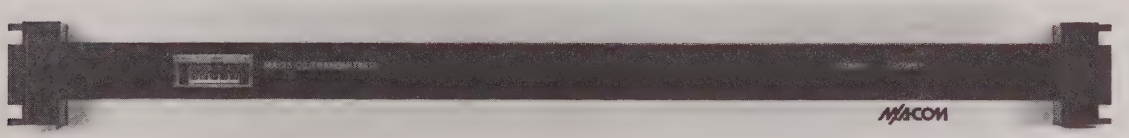


Figure 5-1. Transmitter Baseband Unit – Front View

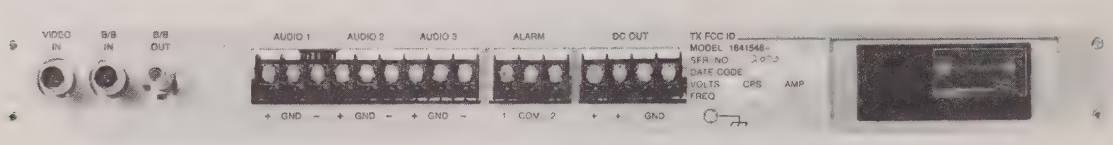


Figure 5-2. Transmitter Baseband Unit – Rear View

Table 5-2. Receiver Baseband Unit – Controls and Indicators (Figure 5-2)

CONTROL OR INDICATOR	MARKING	FUNCTION
FRONT PANEL LED (Green) LED (Green) METER	 POWER CARRIER* 	 Lights when power supply is operational. Lights when RF signals are received. Provides AGC voltage.
REAR PANEL Fuse (1A for 110/220 Vac; 0.5A for 220/240 Vac)	 FUSE-PULL	 Fuse provides overload protection for Receiver subsystem. Pull to remove fuse.

*Only indicates that RF signal is present, does not mean that video, audio or data signals are being demodulated.

Figure 5-3. Receiver Baseband Unit – Front View

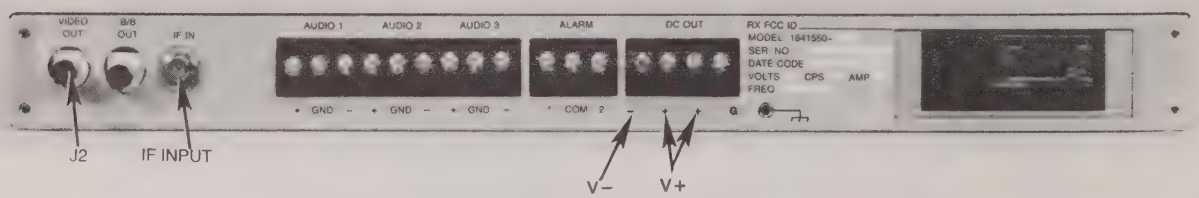


Figure 5-4. Receiver Baseband Unit – Rear View

Table 5-3. Alarms

ALARM	TYPE
TRANSMITTER SUMMARY Source (Gunn) current too high or too low or no prime power.	Form C
RECEIVER SUMMARY Squelch or no prime power.	Form C

TURN-ON PROCEDURE

Turn ON the system by plugging in the Transmitter and Receiver Baseband Units and observe that the POWER indicators (green LED's) light. Video and audio signal connectors on the back panels of the Interface Units are shown in Figures 5-2 and 5-4. Input/output signal levels at the Transmitter and Receiver Baseband Units, respectively, are as follows:

Video/Baseband Signals:

a. Transmitter input: standard 1V P-P, 75 ohm impedance. The video/baseband inputs are terminated into 75 ohms by the Transmitter Baseband Unit.

b. Receiver output: standard 1V P-P, 75 ohm output impedance.

Audio Signals:

a. Transmitter input: +0 dBm (2.2V P-P), 600 ohm balanced input. Connect ground to the common (center) terminal and connect audio wires to the line terminals (on either side of the common terminal). If an unbalanced audio is provided, connect the signal lead to one of the line terminals and connect the ground lead to the common (center) terminal and the other line terminal.

b. Receiver output: +9 dBm (6.2V P-P), 600 ohm balanced output.

At the Receiver Baseband Unit, observe that the CARRIER indicator (green LED) lights. The CARRIER illuminates when RF signals sent by the Transmitter are being received. However, video, audio or data signals may or may not be present. Reception of modulating signals (video, audio or data signals) can be verified by checking the terminating equipment (TV monitor, waveform monitor, etc.) of your particular installation.

At the Receiver Baseband Unit, observe the AGC voltage on the front panel meter for comparison with readings taken during antenna alignment (Section 4). If the CARRIER indicator does not light, either the Transmitter is not operational or the received signal level has dropped below a preset threshold. Under these conditions, the Receiver video and baseband outputs are squelched so that noise is not carried over the system and there is a relay closure to ground at the barrier strip (alarm) on the rear of the Receiver Baseband Unit (Figure 5-4). This relay contact is available for connection to supervisory equipment by the customer.

For signal interruptions of a temporary nature, as may be caused by heavy rains or temporary path blockage, the transmission will automatically resume once the interfering event is removed. However, if the signal interruption is caused by problems with the equipment, refer to troubleshooting procedures in Section 6.

SYSTEM OPERATION AND FIELD MODIFICATION

These systems are designed for unattended, continuous operation. After initial system turn-on, if operating conditions are achieved [i.e., POWER and GUNN (green LED's) on the front panel of the Transmitter Baseband Unit all lit; POWER and CARRIER (green LED's) on the front panel of the Receiver Baseband Unit all lit; and no alarms], the system should require no further attention. No adjustments are necessary.

The system will transmit a full color video channel with up to three 15 kHz audio subcarrier program channels. The subcarrier program channels can be used to carry program audio, low speed data or supervisory orderwire in any combination. Additional subcarrier channels may be added by using external PAC-10/PAC-12 Audio Modulators/Demoduators.

These systems can also handle wideband, high resolution video which occupies the full 8 MHz baseband bandwidth. In these applications, the system is supplied without audio subcarriers.

The flexible design of the system allows modification of the system in the field to change its configuration for any of the above applications. The following field modifications require the services of a qualified technician.

WIDEBAND VIDEO TRANSMISSION. When the system is configured for wideband, high resolution video transmission, it is supplied without audio because the full 8 MHz baseband bandwidth is used. However, a system that is equipped with audio for normal video plus audio service can be modified in

the field for wideband video service by disabling the installed audio subcarrier channels.

For wideband video signal transmission, the VIDEO IN and VIDEO OUT connectors are not used (as in normal video plus audio service). Instead, the incoming video signal is applied to the BB IN type BNC connector on the rear panel of the Transmitter Baseband Unit. Likewise, the wideband video output of the system is at the BB OUT type BNC connector on the rear panel of the Receiver Baseband Unit. By using the BB OUT connector, the Video Low Pass Filter is bypassed thus providing access to the entire 8 MHz baseband spectrum.

INSTALLING AN ADDITIONAL SUBCARRIER CHANNEL. The system has a capacity of three separate audio channels. Additional audio channels can be added to an existing system that is equipped with fewer than the full complement of three audio channels. Auxiliary audio boards, if purchased, can be installed in the Transmitter and Receiver Baseband Units (Figures 5-5 and 5-6), using the following procedure:

Step 1. Remove top covers of Transmitter and Receiver Baseband Units (each cover secured by 9 screws).

Step 2. Insert the Transmitter Auxiliary Audio Board into the main circuit board in the Transmitter Baseband Unit as shown in Figure 5-5. Move the corresponding jumper (W1, W2, or W3) to its ON position (Figures 5-7 and 5-8).

Step 3. Install the Receiver Auxiliary Audio Board into the main circuit board in the Receiver Baseband Unit as shown in Figure 5-6.

Step 4. Replace covers. This step completes installation of the additional audio channel and the system is ready for service. All internal wiring connections to rear panel input/output connectors for three audio channels have been factory installed.

DISABLING A SUBCARRIER CHANNEL. The system is designed so that any of the installed subcarrier channels can be disabled.

No modifications are required at the Receiver. All changes are made on the indoor Transmitter Baseband Unit using the following procedure:

Step 1. Remove top cover of Transmitter Baseband Unit (secured by 9 screws).

Step 2. On the printed circuit board, locate and move jumper W1, W2, or W3 (for Audio 1, 2, or 3, respectively) to the subcarrier OFF position (Figures 5-7 and 5-8). To change jumper, pull plug up and insert in alternate position.

Step 3. Replace cover on Transmitter Baseband Unit.

DISABLING SUBCARRIER PRE-/DE-EMPHASIS. The Pre-/De-Emphasis Networks of the subcarrier boards can be disabled by placing jumpers in the correct position, as follows:

Step 1. Remove top covers of Transmitter and Receiver Baseband Units (each cover secured by 9 screws).

Step 2. In the Transmitter Baseband Unit, locate the jumper (W1) on the Audio Subcarrier Transmitter Board. This jumper is normally installed between Terminals E1 and E2 (pre-emphasis enabled) as shown in Figure 5-9.

To disable audio pre-emphasis, move jumper W1 to connect terminals E2 and E3 as shown in Figure 5-10.

Step 3. In the Receiver Baseband Unit, locate jumper W3 on the Audio Subcarrier Receiver Board. This jumper is normally installed between Terminals E5 and E6 (de-emphasis enabled) as shown in Figure 5-11.

To disable audio de-emphasis, move jumper W3 to connect Terminals E5 and E7 as shown in Figure 5-12.

Step 4. Replace covers on Transmitter and Receiver Baseband Units.

OPTIONAL LOW IMPEDANCE AUDIO OUPTUT (Less Than 50 Ohms). Standard shipments use 600 ohm audio outputs. Optional low impedance audio outputs are available by installing a jumper, as follows:

Step 1. Remove top cover of Receiver Baseband Unit (secured by 9 screws).

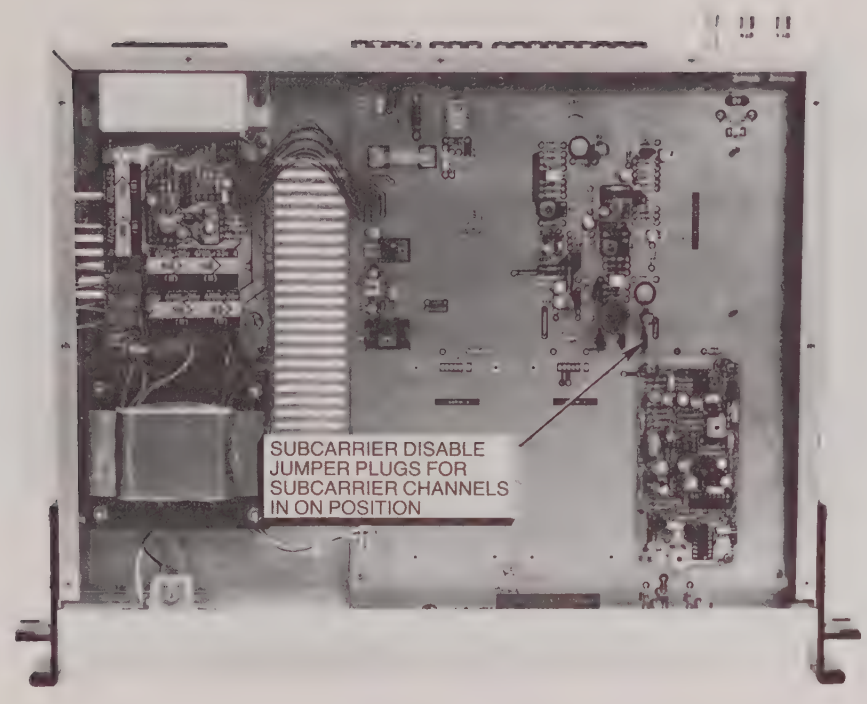


Figure 5-5. ON Postion of Subcarrier Jumper (W1, W2, W3) on Transmitter Baseband Unit

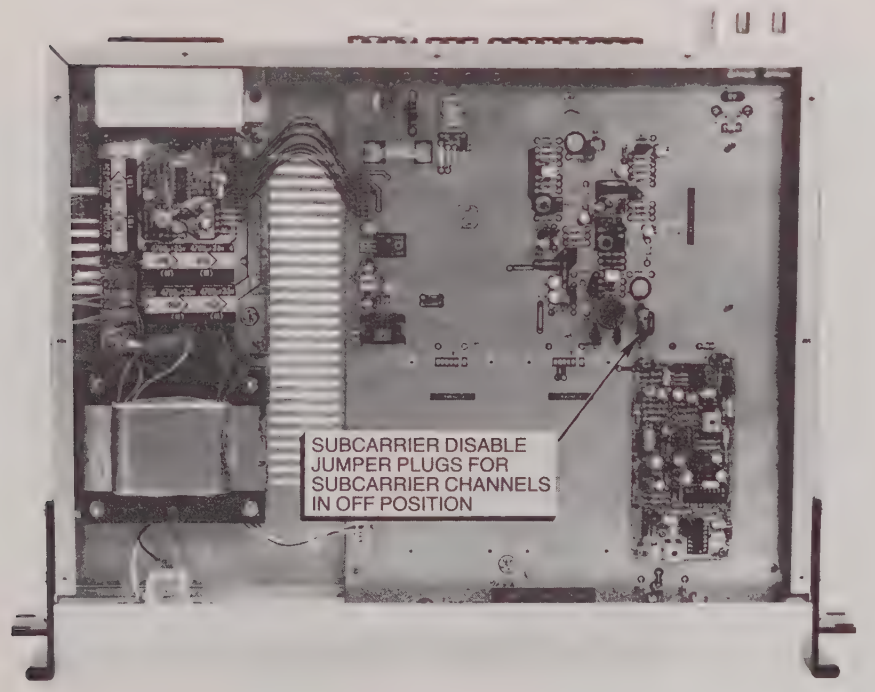


Figure 5-6. OFF Position of Subcarrier Jumper (W1, W2, W3) on Transmitter Baseband Unit

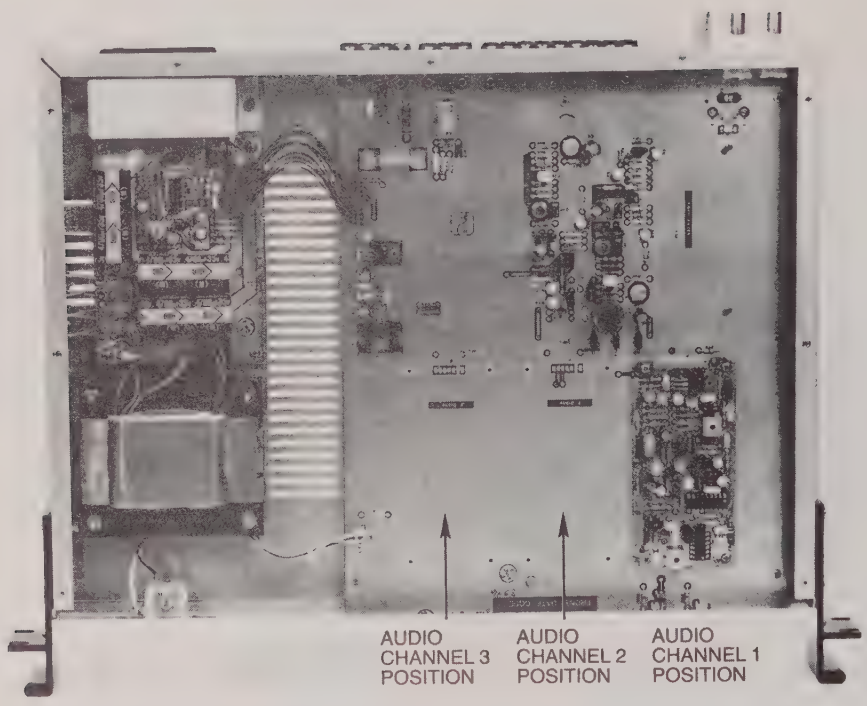


Figure 5-7. Installation of Audio Subcarrier Boards Into MA-23CC Transmitter Baseband Units

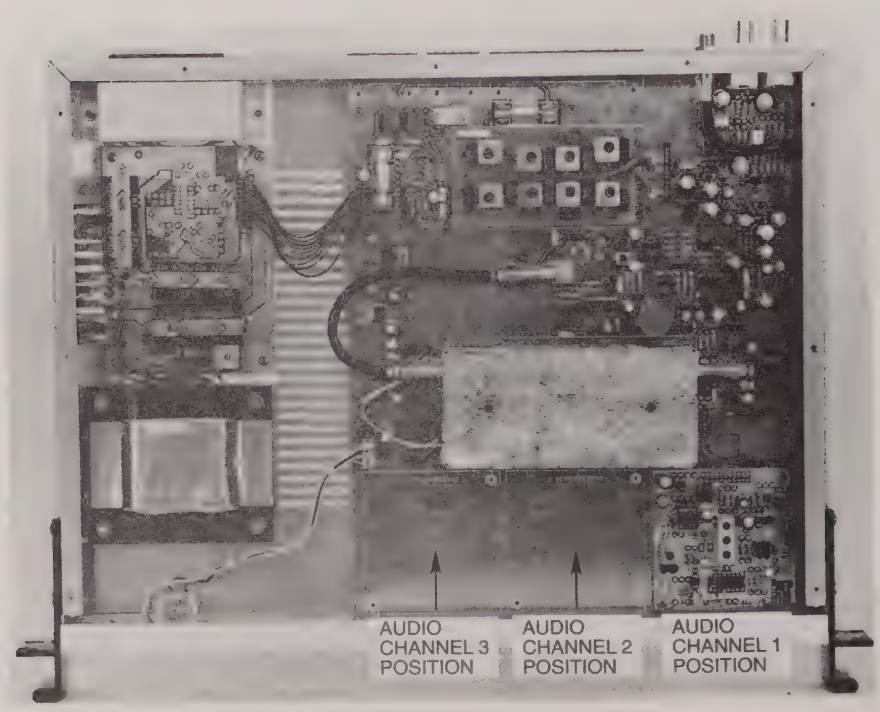


Figure 5-8. Installation of Audio Subcarrier Boards Into MA-23CC Receiver Baseband Units

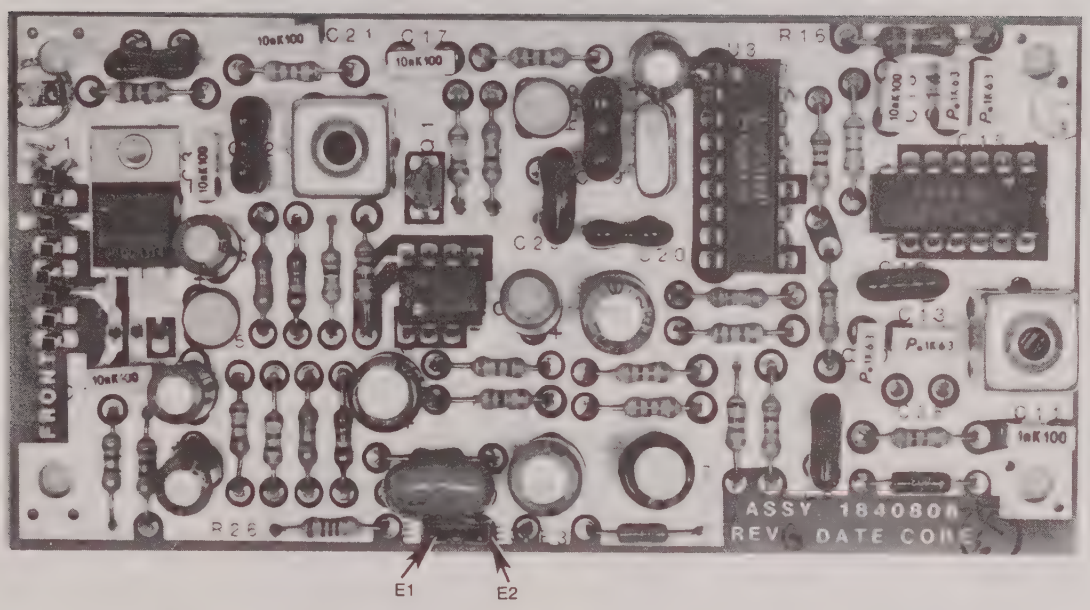


Figure 5-9. Audio Subcarrier Transmitter Board with
Pre-/De-Emphasis Jumper W1 in E1/E2 (Enabled) Position

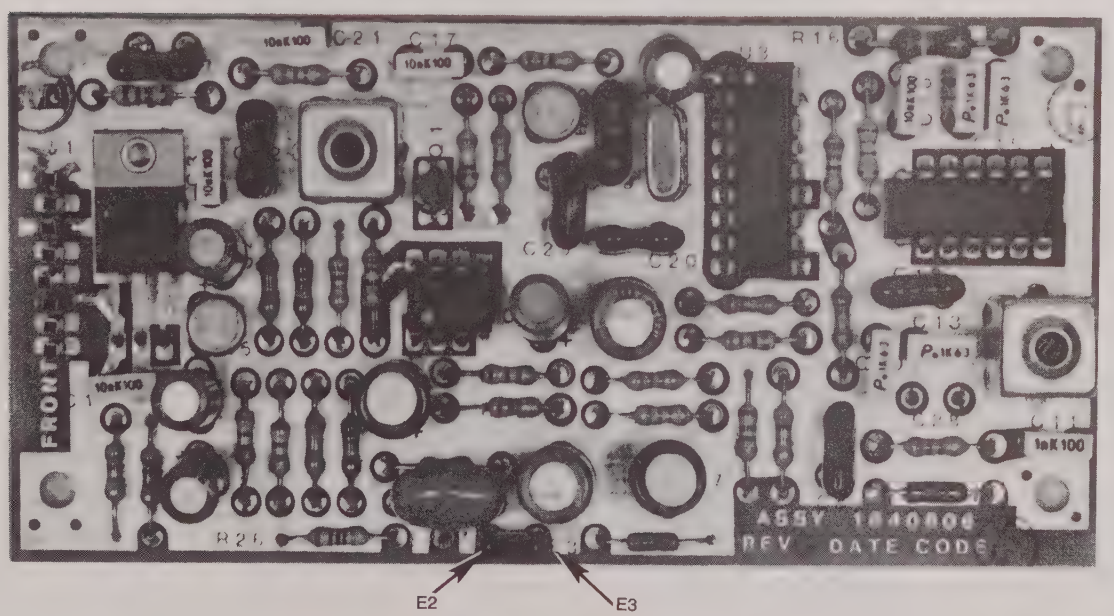


Figure 5-10. Audio Subcarrier Transmitter Board with
Pre-/De-Emphasis Jumper W1 in E2/E3 (Disabled) Position

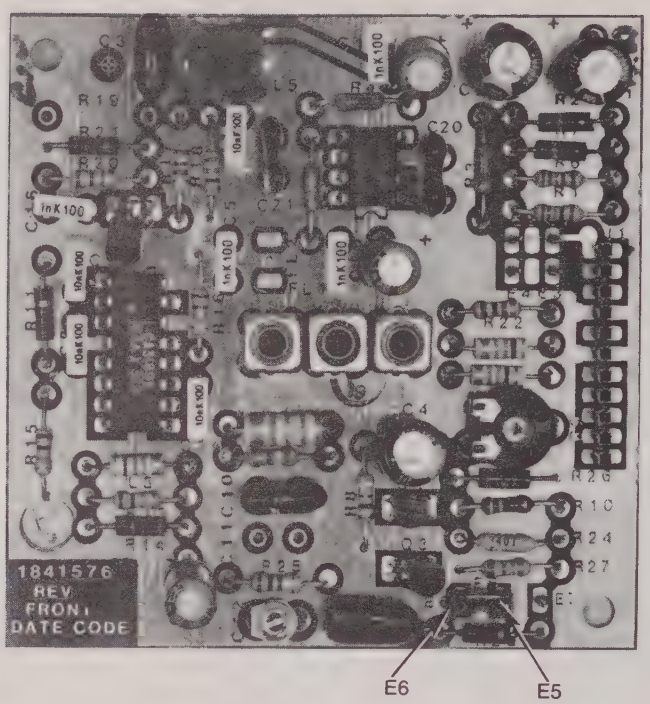


Figure 5-11. Audio Subcarrier Receiver Board with Pre-/De-Emphasis Jumper W3 in E6/E5 (Enabled) Position

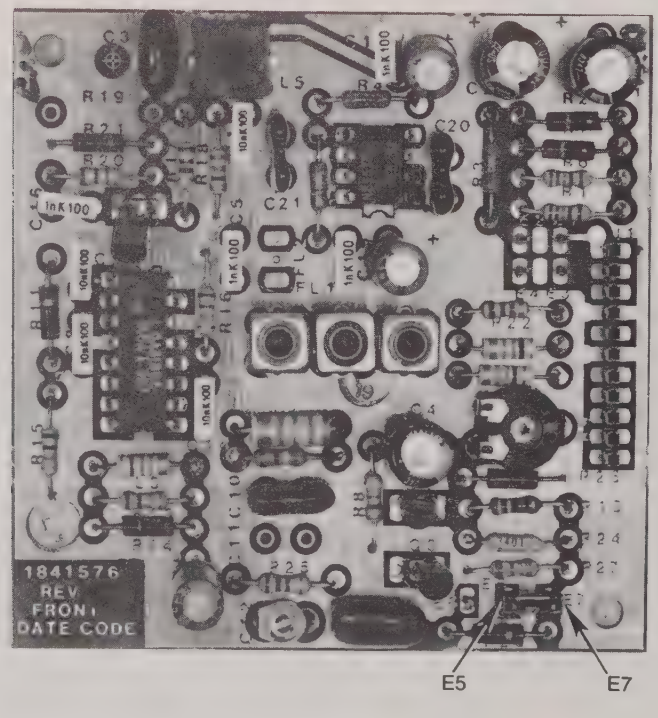


Figure 5-12. Audio Subcarrier Receiver Board with Pre-/De-Emphasis Jumper W3 in E5/E7 (Disabled) Position

Step 2. In the Receiver Baseband Unit, locate jumpers W1 and W2 on the Audio Subcarrier Receiver Board. These jumpers are placed in the store position (pulled up) on Terminals E1 through E4 for 600 ohms output impedance (Figure 5-13).

To change to low impedance output, push down on jumpers W1 and W2 so that contact is made between Terminals E1 and E2, and between terminals E3 and E4 (Figure 5-14).

Step 3. Replace cover on the Receiver Baseband Unit.

DATA TRANSMISSION. The system can be used for data transmission in several ways as described herein.

Using Voiceband or Limited Distance Modems

Low speed data can be transmitted along with video by using any of the audio subcarrier channels and interfacing with external long-haul voiceband modems or limited distance modems. In these cases, data interconnections between the microwave system and the modems are made with twisted wire pairs.

Connect the modem to the microwave system indoor units as follows:

Step 1. Using a twisted wire pair, connect the Transmitter terminals on the modem to the plus (+) and minus (−) terminals of one of the audio connectors on the rear panel of the Transmitter Baseband Unit as shown in Figure 5-15.

Step 2. Using a twisted pair, connect the receiver terminals on the modem to the plus (+) and minus (−) terminals of the corresponding AUDIO connector (same subcarrier channel as used in the Transmitter) on the rear panel of the Receiver Baseband Unit as shown in Figure 5-15.

When using a long-haul voiceband modem at data rates of 56 kbps or less, a modem output level of 0 dBm is normally sufficient (consult your modem supplier for recommended levels). A long-haul voiceband modem is one in which the output is a modulated voiceband carrier.

When using limited distance modems (LDM), signal levels will vary with the data rate. Typical levels are given in Table 5-4, however, optimum signal levels for modems from different vendors may vary. If the carrier is over deviated, transmission performance will be adversely affected. Therefore, be sure to consult your modem supplier for recommended signal levels.

At data rates of 19.2 kbps or higher, it may be necessary to disable subcarrier pre-/de-emphasis for satisfactory performance using the procedure specified earlier.

Table 5-4. Typical LDM Output Levels

DATA RATE (kbps)	OUTPUT LEVEL* (Referenced to 600 Ohms)
Less than 9600	0 dBm
9600	− 3 dBm
19.2	− 7 dBm
56	− 16 dBm

*Typical levels only. Optimum levels for your modem may vary.

Using Microwave or Broadband Modems

Data rates above 56 kbps and up to T2 (6.312 mbps) can be transmitted by interfacing with external microwave or broadband modems. In this case, the entire microwave radio baseband bandwidth is used for data transmission and interconnections between the microwave system and the modem are made with 75 ohm coaxial cable.

Connect the modem to the microwave system indoor units as follows:

Step 1. Using 75 ohm coaxial cable, connect the data output connector of the modem to the BB IN type BNC connector on the rear panel of the Transmitter Baseband Unit as shown in Figure 5-16.

Step 2. Using 75 ohm coaxial cable, connect the data input connector of the modem to the BB OUT type BNC connector on the rear panel of the Receiver Baseband Unit as shown in Figure 5-16.

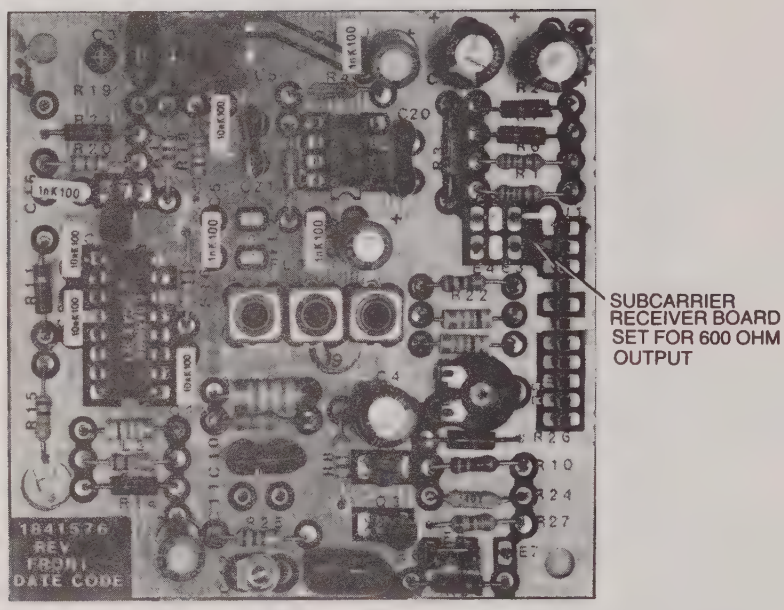


Figure 5-13. Audio Subcarrier Receiver Board Set for 600 Ohm Output

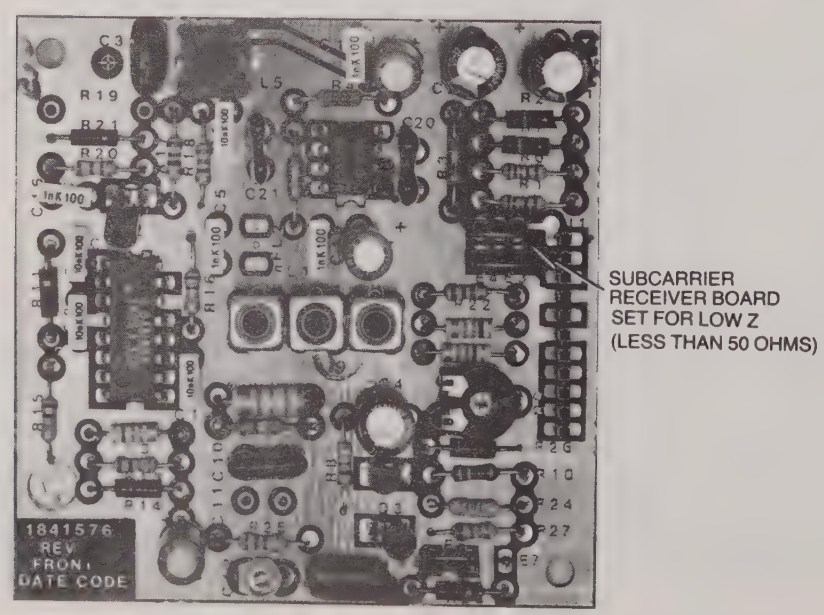


Figure 5-14. Audio Subcarrier Receiver Board Set for Low Z (Less Than 50 Ohms)

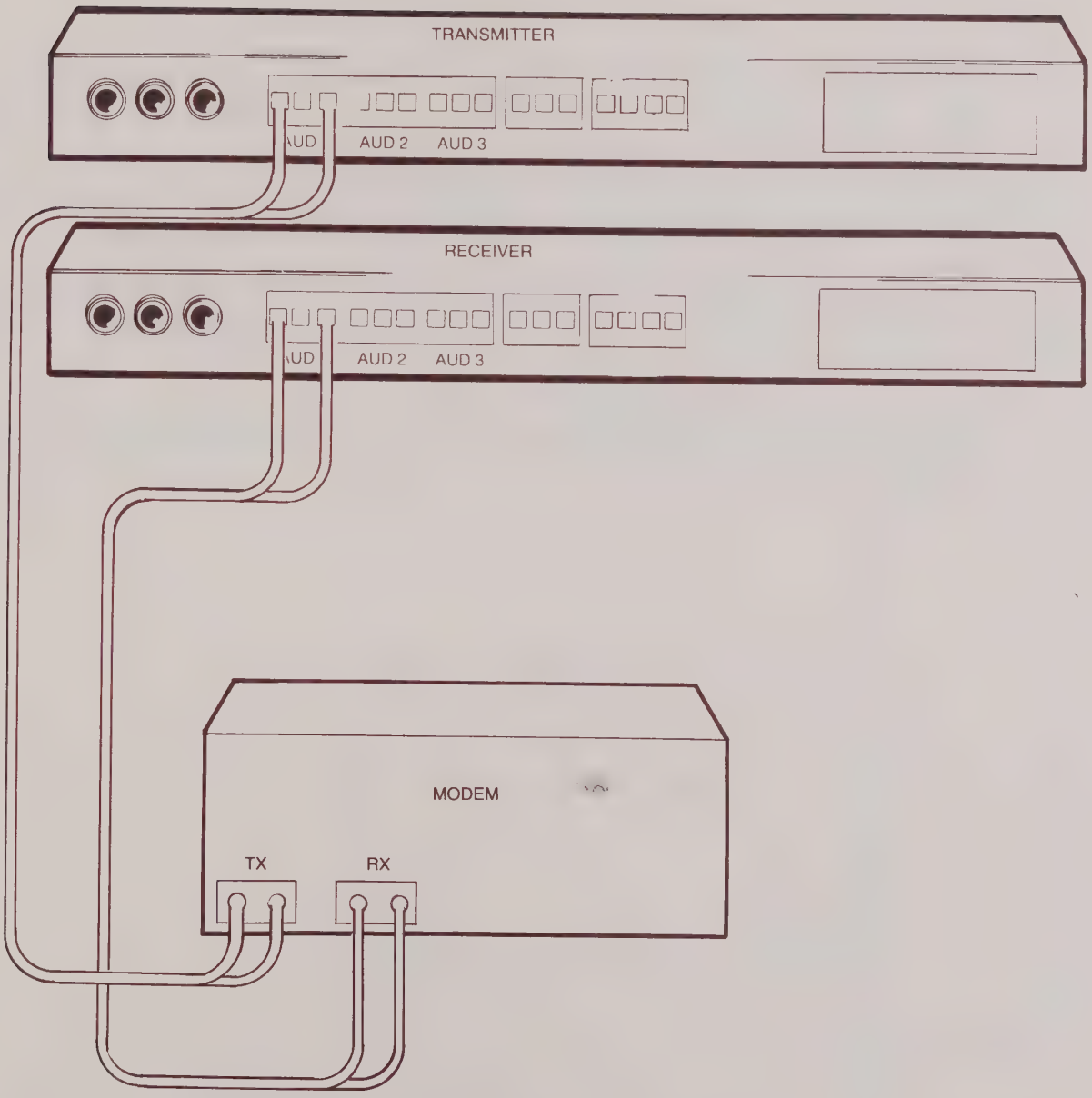


Figure 5-15. Installation Using LDM or Voiceband Modem

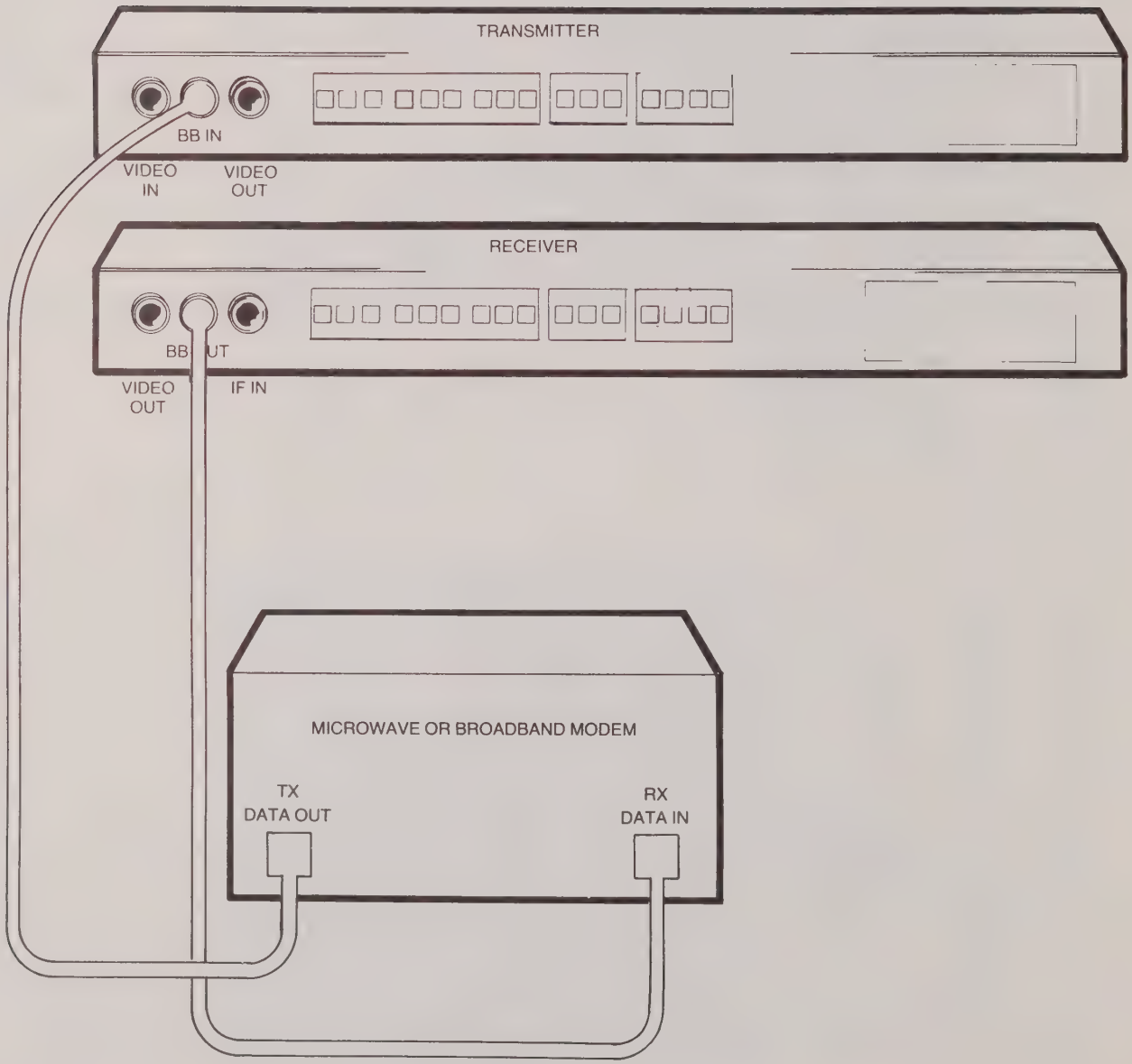


Figure 5-16. Installation Using Microwave or Broadband Modem

SECTION 6
OPERATOR CHECKS AND SERVICES

GENERAL

The totally solid-state 23 GHz System is designed to provide troublefree performance and long life under normal operating conditions. This section outlines operator checks and services which can be performed to correct various fault conditions. Recommended operator corrective action is limited to basic mechanical and electrical checks, and adjustments that are usually performed as part of the normal equipment set-up procedures.

MAINTENANCE LOG

Record all measurements and corrective action taken in a maintenance log as reference information for use in future maintenance and troubleshooting action. A comparison of the measurements entered in the maintenance log is a means of determining any long period changes in equipment performance. The maintenance log should be examined to determine whether any failure that occurs is of a gradual or an abrupt nature.

TROUBLESHOOTING GUIDELINES

Refer to troubleshooting procedures appended to this section of the manual.

M/A-COM MA-23CC Troubleshooting Procedure

This procedure assumes that the antennas are aligned correctly and that polarization has been set and line-of-site exists between the end sites.

Apparatus

Digital Multimeter
Frequency Counter (23 GHz or 200 MHz)
Scope (10 MHz)
Spectrum Analyzer (140 MHz)
Field Strength Meter

Procedure

Step 1. Look up the indicated alarm or failure mode in Column A.
Step 2. When alarm or failure is located, move across to Column B for possible fault cause.
Step 3. Select a cause and move to Column C and locate evaluation parameter.
Step 4. If evaluation parameter is incorrect, move to Column D for corrective action.
Step 5. If evaluation parameter is correct, move to Column E for next step or cause.

A	B	C	D	E
FAILURE MODE/ALARM	**POSSIBLE CAUSE**	**EVALUATION**	**CORRECTIVE ACTION**	**NEXT STEP**
Scan Column A for failure mode or alarm. When failure located, go to Column B and scan possible causes of that failure mode or alarm.	Scan Column B for possible cause of the failure mode or alarm and then proceed to Column C and perform the measurement or evaluation noted.	Perform measurement or evaluation. If parameter noted in Column C is incorrect, go to Column D for corrective action. If parameter noted in Column C is correct, go to Column E for next step or possible cause.	If parameter noted in Column C is incorrect, perform the noted action.	If parameter noted in Column C is correct, see next step or possible cause.

A	B	C	D	E
FAILURE MODE/ALARM	**POSSIBLE CAUSE**	**EVALUATION**	**CORRECTIVE ACTION**	**NEXT STEP**
1. No TX power LED.	a. TX Power Supply.	a. Confirm + 14 on TB-3 and 4 with load applied.	1) Check ac power. 2) Check external fuse. 3) Check Power Supply.	a. Replace defective power LED.
2. No TX Gunn current LED.	a. Confirm presence of the TX power LED. If incorrect, see No TX power LED fault procedure.*			
	b. Defective interface cable.	b. Confirm + 14 on TB-3 and 4 with load applied.	1) Check internal fuse. 2) Check power cable wiring. 3) Check cable connectors.	b. See defective TX Regulator.
	c. Defective TX Regulator.	c. Measure Gunn current (920 mA) TB3-3 and 4.	c. Check Gunn Regulator output voltage (5.5V).	c. See defective TX Gunn.
	d. Defective TX Gunn.	d. Measure TX frequency (± 7 MHz) (+ 17 dBm).	d. Replace TX Gunn.	d. Check LED and meter.
3. No RX power LED.	a. Receiver Power Supply.	a. Confirm + 20V on TB3-2 and 3, and − 18V on TB3-4.	1) Check ac power. 2) Check external fuse. 3) Check internal fuses.	a .Replace defective power LED.
4. No carrier LED or no AGC indication or low AGC indication.	a. Confirm presence of RX power LED. If incorrect, see no RX power LED fault procedure.*			
	b. If AGC is present, check LED.*			
	c. Confirm presence of TX Gunn current. If incorrect, see no TX Gunn current fault procedure.*			
	d. Defective dc power cable or connector.	d. Confirm + 20V on TB3-2 and 3, and − 18V on TB3-4.	1) Check external fuses. 2) Check cable connectors. 3) Check cable wiring.	d. See defective IF signal cable.
	e. Defective IF cable or connector.	e. Measure AGC voltage on IF cable center conductor (2.5 to 7V).	e. Check IF cable and connectors. If correct, see defective Gunn Regulator.	e. See incorrect squelch setting.
	f. Incorrect squelch setting.	f. Confirm squelch threshold.	f. Adjust R60 to set squelch threshold at − 76 dBm (37 dB signal-to-noise).	f. Replace RX Controller.
	g. Defective Regulator.	g. Measure Gunn current TB3-2 and TB3-3 on RX Control Unit (320 mA).	g. Measure regulator outputs (located in RF Unit). If incorrect, replace Regulator. J1 Pins 4, 5, 7 J2 Pins 3, 4 P4 = + 5V P5 = + 12V P7 = + 18V P3 = + 12V P4 = − 12V	g. See defective RX Gunn.
	h. Defective RX Gunn.	h. Measure IF frequency (140 MHz ± 7 MHz).	1) Realign RX Gunn IF frequency if within 40 MHz and check for 3 to 6V on heater element. Adjust R2 if necessary for correct level. Element should be 60°. Make sure that the Gunn frequency is not reacting to temperature before adjusting. See RX Gunn alignment procedure. 2) If no IF is present, check RX Gunn frequency. If incorrect, replace Gunn/Mixer-Preamp.	h. See defective Mixer-Preamp.

*Indicates see noted procedure first.

A	B	C	D	E
FAILURE MODE/ALARM	**POSSIBLE CAUSE**	**EVALUATION**	**CORRECTIVE ACTION**	**NEXT STEP**
	i. Defective Mixer-Preamp.	i. Measure output of Mixer (20 dB greater than RCL RX carrier level into RX).	i. Replace Mixer-Preamp.	i. See Defective IF Amp.
	j. Defective IF Amp.	j. Measure output of IF Amp (−6 dBm) (2.5 to 9V AGC).	j. Check interconnect cables and connectors. If good, replace IF Amp.	j. See defective TX Gunn.
	k. Defective TX Gunn.	k. Measure TX frequency (±7 MHz).	k. See TX Gunn alignment procedure. If incorrect, replace Gunn.	k. Replace IF Amp.
5. No video.	a. Confirm presence of RX AGC. If absent, see no AGC fault.*			
	b. Defective TX Controller.	1) Measure video input (1V P-P) J1.	1) Check video feed.	1) Measure BB output.
		2) Measure BB output (2V P-P) pre-emphasis 525, J2 with a 1V test tone applied.	2) Adjust R6. If incorrect, replace TX Controller.	2) Check BB output cable and connectors.
	c. Defective TX Gunn.	1) Confirm modulation on TX Gunn varactor and bias (voltage level noted on Gunn).	1) Recheck steps and all internal cables and connections.	1) Confirm modulation on RX IF cable.
		2) Confirm modulation on RX IF cable.	2) Replace TX Gunn.	2) See defective RX Controller.
	d. Defective RX Controller.	d. Confirm that Low Pass Filter is installed (E10-E11).	d. Install Low Pass Filter.	d. Check Receiver squelch threshold.
	e. Incorrect RX squelch setting.	e. Check squelch threshold.	e. Adjust R60 to set threshold at −76 dBm (37 dBm signal-to-noise).	e. See misaligned BB output.
	f. Misaligned BB output.	f. Check BB output of RX Controller (1V P-P) with a 1V P-P level applied to the TX video input.	f. Adjust R33 on RX video card for 1V P-P.	f. See misaligned video output.
	g. Misaligned video output.	g. Check video output of RX Controller (1V P-P) with a 1V P-P level applied to the TX video input.	g. Adjust R69 on RX video card for 1V P-P.	g. Replace RX Controller.
6. Intermittent video or noisy video or low video level.	a. Defective BB cable or power cable.	a. Check TX and RX video interconnect cables and connectors.	a. Replace or repair.	a. See misaligned RX squelch adjustment.
	b. Misaligned RX squelch adjustment.	b. Check RX squelch threshold.	b. Adjust R60 to set squelch threshold at −76 dBm (37 dBm signal-to-noise).	b. See misaligned TX Controller.
	c. Misaligned TX Controller.	c. Measure BB output (2V P-P) with a 1V test tone applied to the TX video input (J1).	c. Adjust R6 for correct level.	c. See misaligned RX Controller.
	d. Misaligned RX Controller.	d. Measure video output (1V P-P) with a 1V test tone applied to the TX video input (J1).	d. Adjust R69 for 1V P-P output.	d. See misaligned BB output.
	e. Misaligned BB output.	e. Measure BB output (1V P-P) with a 1V test tone applied to the TX video input (J1).	e. Adjust R33 for 1V P-P output.	e. See hum.

Indicates see noted procedure first.

A	B	C	D	E
FAILURE MODE/ALARM	**POSSIBLE CAUSE**	**EVALUATION**	**CORRECTIVE ACTION**	**NEXT STEP**
	f. Hum.	f. Check ground potential between the indoor and outdoor units.	f. Install a ground wire between the indoor and outdoor units or install a hum stop filter.	f. Check station ground and for ground loops.
	g. Poor station ground.	g. Check for ground loops and confirm equipment grounding to rack.	g. Ground and bond all equipment to the equipment rack and common bus.	g. See unregulated ac input.
	h. Unregulated ac input.	h. Check ac input for level and noise.	h. Insert an isolation transformer or consider a UPS.	h. *
	i. See no video output.*			
	j. See no AGC.*			
	k. Confirm line-of-site, and path alignment.			
7. Incorrect differential phase and gain.	a. Misaligned IF Filter.	a. Confirm all video jumpers and cables for correct grounding and VSWR.	a. Repair or replace.	a. Adjust L7 and L8 on RX IF Filter.
8. High or low video frequency response.	a. Misaligned video circuit.	a. Confirm all video jumpers and cables for correct grounding and VSWR.	a. Repair or replace.	a. Response: adjust C13 and C15. De-emphasis: adjust R22 and R17. Cable equalization: adjust R103 and R101.
9. Inverted video.	a. Incorrect operating frequency.	a. Measure TX frequency. Check FCC license.	a. Contact M/A-COM.	a. Confirm RX RF frequency.
	b. Incorrect location of video jumper.	b. Confirm location of W2 located within RX Controller. See maintenance manual.	b. See incorrect RX frequency.	
	c. Incorrect LO setting.	c. Measure RX frequency and confirm channel frequency label.	c. If channel frequency noted on label is correct, see RX Gunn alignment procedure.	c. Contact M/A-COM if channel frequency label is incorrect.
10. No audio.	a. Confirm presence of AGC. If absent, see no AGC fault.*			
	b. Confirm video presence. If absent, see no video output fault.*			
	c. No internal audio.	c. Open TX and RX Controllers and locate audio card.	c. Contact seller.	c. Audio jumpers in wrong location.
	d. Audio jumpers incorrect location.	d. See maintenance manual.	d. Relocate or add.	d. Confirm audio input level.
	e. Defective TX Controller.	1) Check audio input level (0 dBm).	1) Restore proper level.	1) Check subcarrier level at BB output, J2.
		2) Check output level (200 mV P-P) on BB output, J2 per audio channel.	2) Adjust R25. If incorrect, replace audio modulator.	2) See defective RX Controller.
	f. Defective RX Controller.	f. Measure RX audio output (+9 dBm) with a 0 dBm test tone at 1 kHz applied to the TX modulator.	f. If low, adjust R9. If no output, replace audio demodulator.	f. Check external cables.
11. Noisy audio or intermittent audio.	a. See no audio output fault.*			
	b. See no video/intermittent video output fault.*			

*Indicates see noted procedure first.

A	B	C	D	E
FAILURE MODE/ALARM	**POSSIBLE CAUSE**	**EVALUATION**	**CORRECTIVE ACTION**	**NEXT STEP**
	c. TX off frequency.	c. Measure TX frequency (± 7 MHz).	c. See TX Gunn alignment procedure.	c. RX Gunn off frequency.
	d. RX off frequency.	d. Measure IF frequency (140 MHz ± 7 MHz).	d. See RX Gunn alignment procedure.	d. Check all cables and connectors.
12. Audio buzz or audio distortion during high video peaks.	a. Incorrect video input level.	a. Confirm 1 V P-P input to TX.	a. Reduce level to 1 V.	a. See incorrect TX deviation.
	b. Incorrect TX deviation.	b. Confirm BB output (2V P-P) with 1 V test tone applied to TX video input.	b. Reduce BB output to 2V, R6.	b. See high frequency noise.
	c. High frequency noise.	c. Insert a 5.0 MHz Low Pass Filter in the TX video input line to confirm feed.	c. Insert a 5.0 MHz Low Pass Filter.	c. See incorrect subcarrier level.
	d. Incorrect subcarrier	d. Check audio modulator output level (200 mV per channel) at BB output of TX with a 0 dBm test tone at 1 kHz applied to TX audio input.	d. Adjust R25 for 200 mV P-P at J2 of TX.	d. See noisy or intermittent audio fault.
13. Audio distortion during peak audio periods.	a. Incorrect audio input level.	a. Confirm 0 to − 6 dBm input.	a. Reduce audio level to 0 dBm.	a. Misaligned audio deviation.
	b. Misaligned audio deviation.	b. Adjust audio deviation for 75 kHz (1 kHz at 0 dBm).		
14. Subcarrier interferes with the remote video monitor.	a. Feedback.	a. Insert a 5.0 MHz Low Pass Filter at video input of TX Controller or output of RX Controller.		

The following table provides the standard and typical levels found within the MA-23CC radio. Also listed is the location or adjustment for each parameter.

PARAMETER	LEVEL	REMARKS
TRANSMITTER CONTROLLER		
Video Input Level	1V P-P	75Ω
Low Pass Filter Bypass		W5
BB Output	2V P-P	R6,
Pre-Emphasis	525	R26 and R27
Select Jumper	525 or 625	W7
Audio Input	0 dBm (600 ohm)	For 75 kHz deviation, factory pre-set w/1 kHz test tone.
Subcarrier #1 Disable	E7-8	W1 Control Board
Subcarrier #2 Disable	E9-10	W2 Control Board
Subcarrier #3 Disable	E11-12	W3 Control Board
Subcarrier Deviation		R5 Audio Board
Subcarrier Level		R25
Subcarrier Modulation Linearity		L3 and C28
Subcarrier Level and Linearity		L4
DC Volt to RF	+14	TB3-3 and 4
DC Power Fuse	2A	F1
DC Output Adjust		R2
Alarm Circuit Disable		W6
Alarm Threshold		R16
Factory Test Jumper		W4
TRANSMITTER RF HEAD		
Regulator Input	+14	
Gunn Voltage	+5.5	Typical set as marked on Gunn.
Modulated Gunn Voltage	+5.5	Typical set as marked on Gunn.
Gunn Current	920 mA	
RECEIVER CONTROLLER		
Baseband Output Level	1V P-P	R33
Video Output Level	1V P-P	R69
Video Invert Jumper		W2
De-Emphasis Select	525 or 626	W3
De-Emphasis	525	R19 and R22
Audio Output	+9 dBm	R9 w/1 kHz test tone.
Audio Output Impedance	600 Ohm Balanced	W1 and W2
Audio De-Emphasis Disable		W3
Subcarrier Level and Linearity		L5
Squelch	−78 dB	R60
Factory Test Jumper		W1
DC Volt to RF	±20	
DC Power Fuse (+)	2A	F1
DC Power Fuse (−)	0.5A	F2
Meter Zero		R52
RECEIVER RF HEAD		
Regulator Input	+20 and −18	
Gunn Voltage	+5.5	Typical set as marked on Gunn
Modulated Gunn Voltage	+5.5	Typical set as marked on Gunn
Gunn Current	320 mA	

Gunn Alignment

Transmitter

Step 1. With a 23 GHz frequency counter and waveguide transition, sample the frequency in front of the TX Antenna radome or attach a WR-75 to Type N adapter to the MA-23CC RF outdoor unit WR-42 flange.

Step 2. Carefully loosen the support locking nut on the Gunn tuning slug with a 5/64 Allen wrench.

Step 3. Then with a slotted screw driver, adjust the tuning slug carefully (one turn equals a 1.2 GHz change in frequency) to obtain the correct frequency.

Step 4. For optimum operating range, set the frequency within 7 MHz at 25°C.

Step 5. To increase the frequency, turn the tuning slug counter-clockwise (ccw).

Step 6. To decrease the frequency, turn the tuning slug clockwise (cw).

Step 7. This adjustment is very fragile and is not covered under warranty if damaged.

Step 8. Note: frequency may change while tightening the locking collar.

Receiver

Step 1. Attach a 140 MHz spectrum analyzer to the IF cable output.

Step 2. Loosen the Gunn locking nut located on the Gunn with a hollowed out 1/4″ nut driver and slotted screw driver.

Step 3. This adjustment is very fragile and is not covered under warranty if damaged, so be very carefull. One turn equals a 1.2 GHz change in frequency.

Step 4. While monitoring the 140 MHz signal on the spectrum, carefully loosen the lock nut with the nut driver and at the same time maintain pressure on the screw driver to prevent movement of the screw adjustment.

Step 5. Back the locking nut off by 1/4 turn and adjust the screw clockwise (cw) if a decrease in frequency is required.

Step 6. Turn the screw counter-clockwise (ccw), if an increase in frequency is required.

Step 7. Upon completion, resecure the locking nut.

Step 8. The actual LO frequency may be tuned 140 MHz above or below the Transmitter frequency, depending on the system configuration.

SECTION 7
REFERENCE DRAWINGS

Figure 7-1. MA-23CC Antenna/RF Assembly (2 Foot) PN 1841480 7-3

Figure 7-2. 23 GHz Antenna Mount (2 Foot) PN 1841924C 7-7

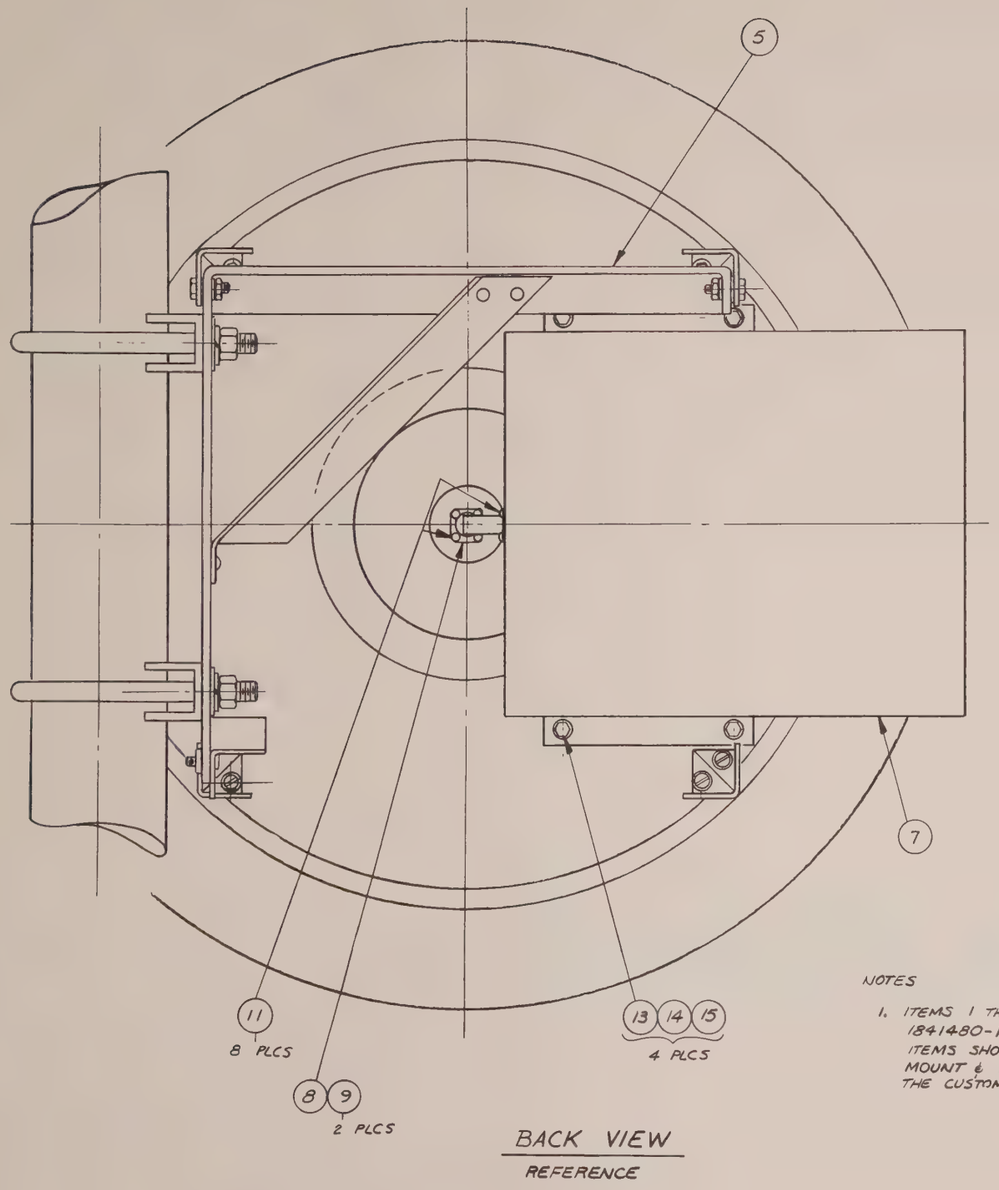
Figure 7-3. 23 GHz Receiver Multiplex System Assembly PN 842754B 7-9

Figure 7-4. 23 GHz Transmitter Multiplex System Assembly PN 842755B .. 7-17

Figure 7-5. 23 GHz Multiplex Mounting Hardware Kit PN 843821-2A 7-25

PARTS LIST FOR 1841480

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	1841475-1	Reflector
2	1	1841476-1	Radome
3	1	1841477-1	Shroud
4	1	1841472-1	Feed Assembly (G1 Only)
5	Ref	1841924-1	Antenna Mount Assembly
6		—	—
7	Ref	1841478-99	RF Box Assembly
8	Ref	1842031-1	Waveguide Assembly Flexible
9	Ref	188160-17	Gasket, O-Ring (UG-598A/U), 2 Places
10		—	—
11	Ref	188424-3	Screw, Pan Head, 4-40 x 3/8 Lg (11 Places)
12	20	188428-3	Screw, Pan Head 8-32 x 3/8 Lg (20 Places)
13	Ref	188409-42	Bolt, Hex Head 12-24 x 1/2 Lg (4 Places)
14	Ref	188480-12	Washer, Flat #12 (4 Places)
15	Ref	188481-12	Washer, Lock #12 (4 Places)
16	1	843560-1	Dual Polarity Feed (G1 Only)



BACK VIEW
REFERENCE

NOTES

1. ITEMS 1 THRU 4 TO BE PREASSEMBLED AS 1841480-1. BACK VIEW & ALL OTHER ITEMS SHOWN FOR REFERENCE ONLY. THE MOUNT & RF BOX WILL BE ASSEMBLED BY THE CUSTOMER.

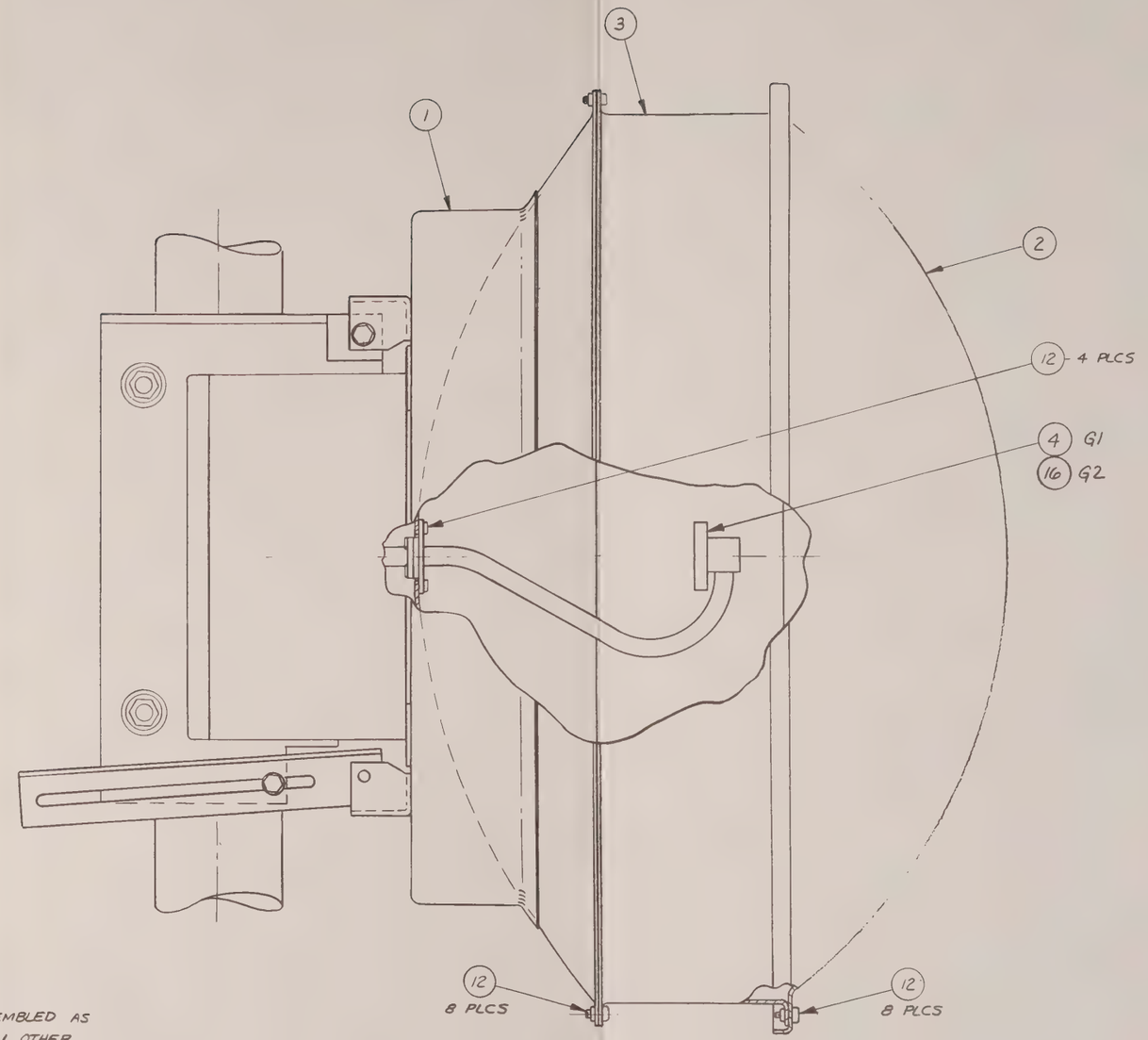
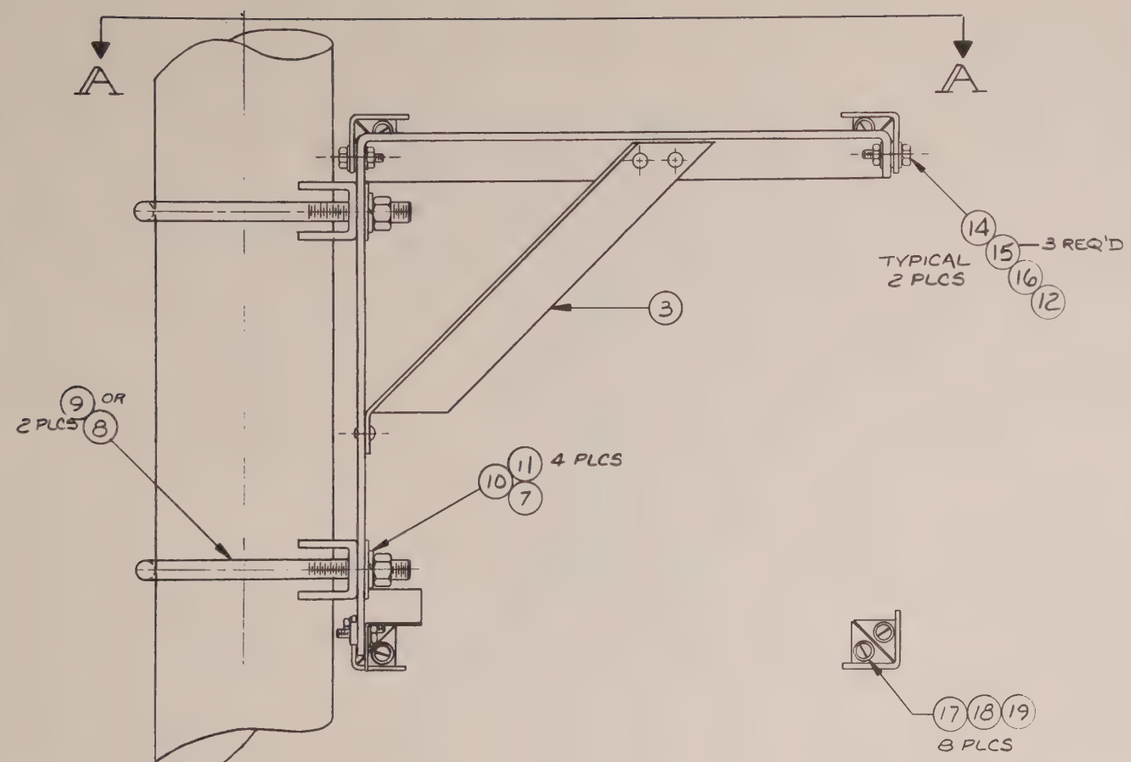
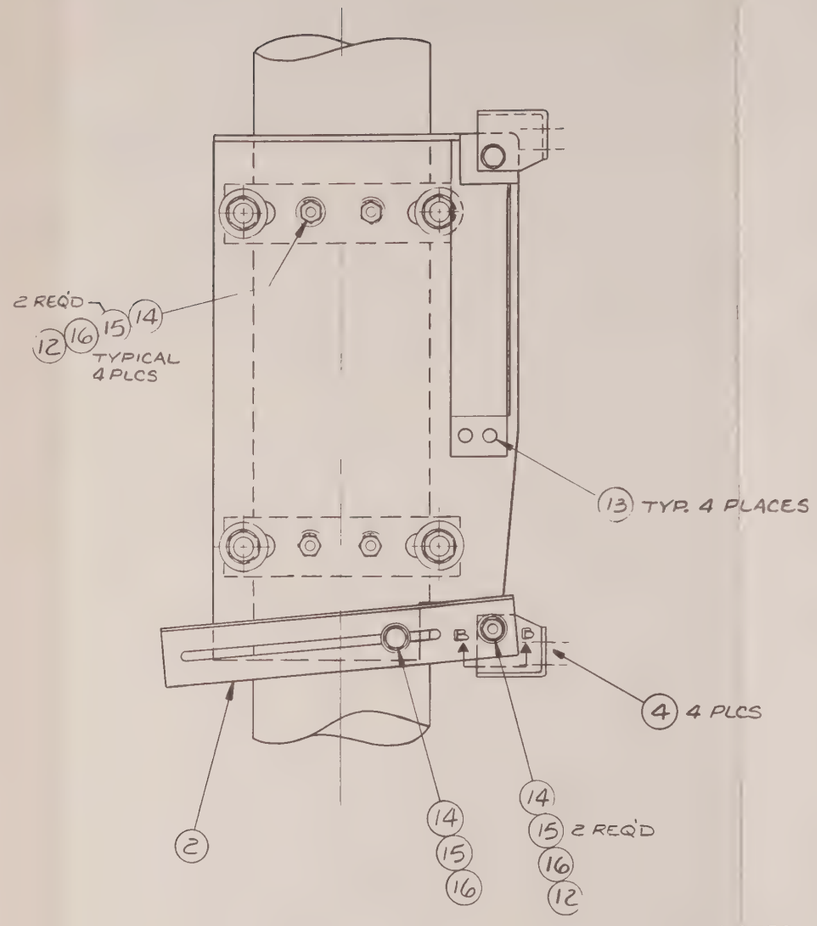
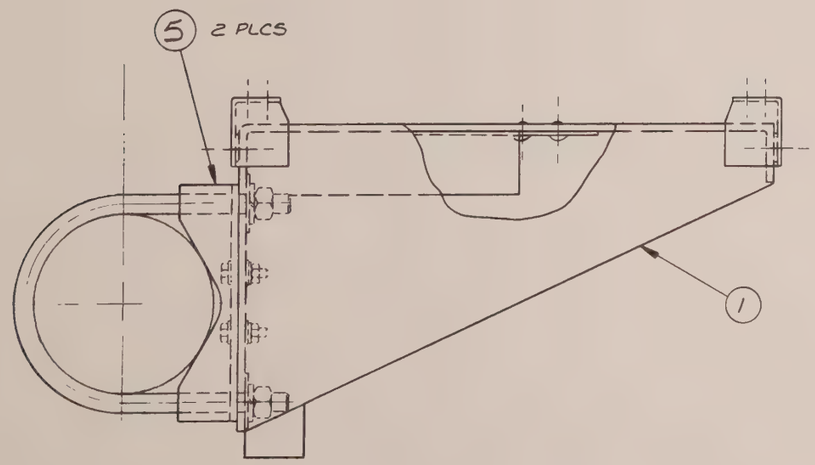


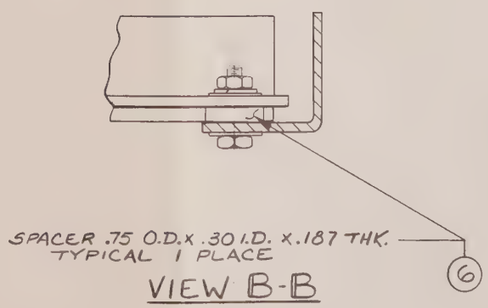
Figure 7-1. MA-23CC Antenna/RF Assembly (2 Foot) PN 1841480







VIEW A-A



VIEW B-B

NOTES

1. ITEMS 1, 3 & 5 TO BE PRE-ASSEMBLED. REMAINING ITEMS TO BE SHIPPED UNASSEMBLED. SEPARATE HARDWARE BETWEEN #1/2, #1/4 & #12, BAG & LABEL. SHIP ONE COMPLETE MOUNT KIT PER BOX. BOX TO BE LABELED "ANTENNA MOUNT 1841924".

Figure 7-2. 23 GHz Antenna Mount (2 Foot) PN 1841924C

(PARTS LIST FOR 1841924C)

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	1841925-1	Mounting Plate
2	1	1841938-1	Elevation Brace
3	1	1841926-1	Diagonal Brace
4	4	1841939-1	Reflector Standoff
5	2	1841927-1	Channel 1-1/2 x 1-1/2 x 3/16
6	1		Spacer, 0.75 o.d. x 0.31 d x 0.187 thk
7	4		Nut, 1/2-13 UNC
8	2		U-Bolt Galv. 3.5 ID x 5.5 DP 1/2-13 x 1-1/2 THD
9	2		U-Bolt Galv. 4.5 ID x 6.5 DP 1/2-13 x 1-1/2 THD
10	4		Washer, Lock Split 1/2″
11	4		Washer, Flat 1/2″
12	7		Nut, 1/4″-20 Stainless Steel
13	4		Rivet, Dome 3/16″
14	8		Bolt, 1/4″-20 x 1″ Stainless Steel
15	25		Washer, Flat 1/4″ x 1/2″
16	8		Washer, Lock Split 1/4″
17	8		Bolt, Roundhead #12-24 x 5/8″ Stainless Steel
18	8		Washer, Flat #122
19	8		Washer, Lock Split #12
20	2	1841939-2	Reflector Standoff

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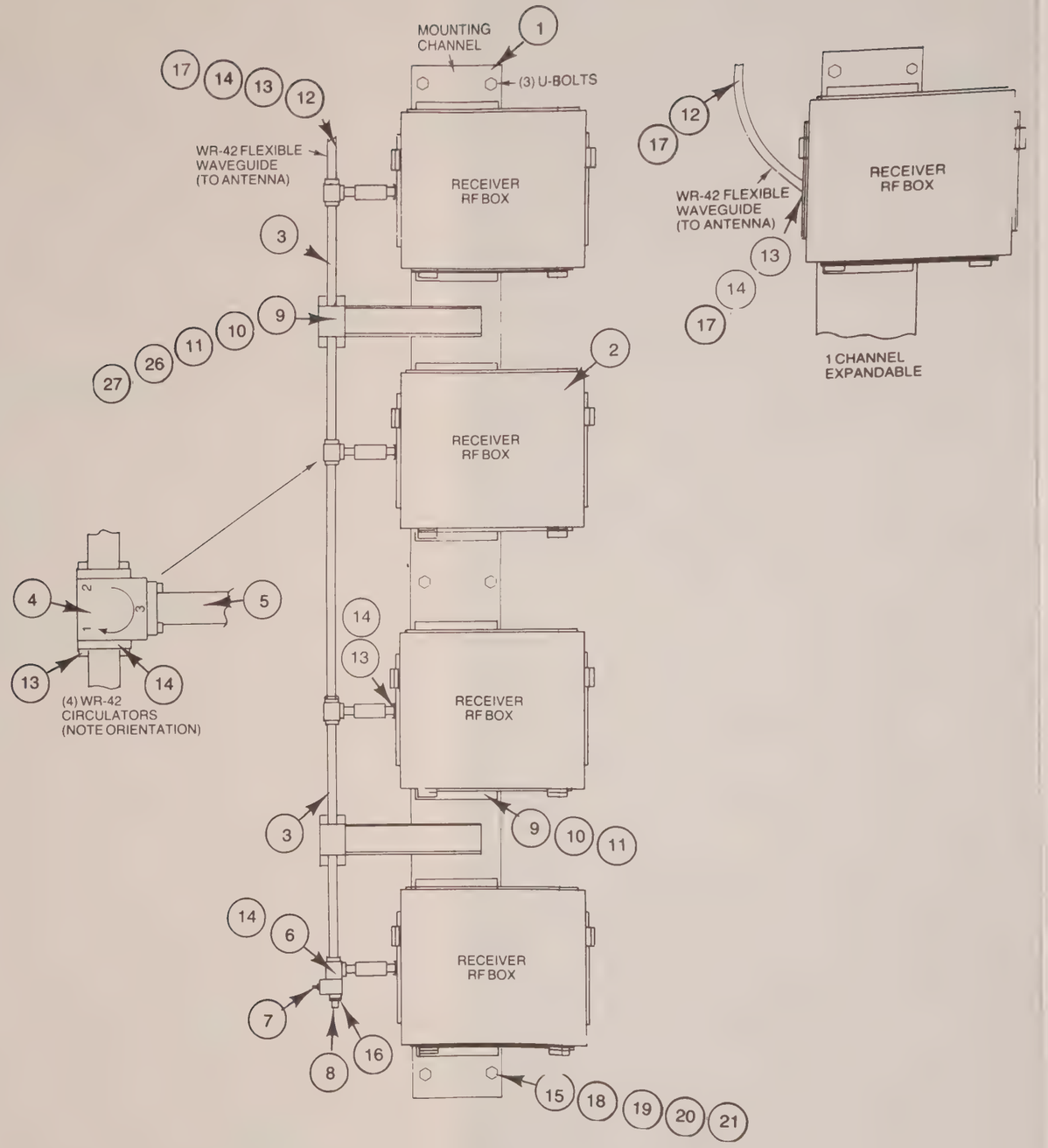

Figure 7-3. 23 GHz Receiver Multiplex System Assembly PN 842754

PARTS LIST FOR 842754-1

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	842688-1	Mounting Channel
2	1	1841478-3	Receiver Assembly
3		—	—
4		—	—
5		—	—
6	1	842750-1	Pressure Block
7	1	89800-3	Pressure Valve, Schrader 91660060
8		—	—
9	10	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	10	188480-10	Flat Washer #10
11	10	188481-10	Lock Washer #10
12	Ref	88160-23	WR-42 Flexible Waveguide Assembly, 3 Ft.
13	Ref	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	Ref	188160-17	O Ring, Waveguide
15	3	842751-1	V-Block
16	4	189454-13	Screw, Soc. Hd. Cap 4-40 x 1-3;7 Lg
17	Ref	843821-2	Mounting Hardware Kit
18	Ref	808058-6	U-Bolt 7/16-14UNC, 4.5″ I.D.
19	Ref	188460-42	Nut, Hex 7/16-14UNC
20	Ref	188481-42	Lock Washer, 7/16
21	Ref	188480-22	Flat Washer, 7/16
22	Ref	1841550-99	Receiver Baseband Final Assembly
23	Ref	1841576-99	Receiver Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26		—	—
27		—	—
28	Ref	88160-26	Gasket, Flat WR-42

PARTS LIST FOR 842754-2

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	842688-1	Mounting Channel
2	2	1841478-3	Receiver Assembly
3	1	1841727-3	WR-42 Waveguide Assembly
4	2	1841724-1	Circulator
5	2	1841726-99	Filter
6	1	842750-1	Pressure Block
7	1	89800-3	Pressure Valve, Schrader 91660060
8	1	1841725-1	WR-42 Waveguide Termination
9	20	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	20	188480-10	Flat Washer #10
11	20	188481-10	Lock Washer #10
12	Ref	88160-23	WR-42 Flexible Waveguide Assembly, 3 Ft.
13	24	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	8	188160-17	O Ring, Waveguide
15	3	842751-1	V-Block
16	4	189454-13	Screw, Soc. Hd. Cap 4-40 x 1-3;7 Lg
17	Ref	843821-2	Mounting Hardware Kit
18	Ref	808058-6	U-Bolt 7/16-14UNC, 4.5" I.D.
19	Ref	188460-42	Nut, Hex 7/16-14UNC
20	Ref	188481-42	Lock Washer, 7/16
21	Ref	188480-22	Flat Washer, 7/16
22	Ref	1841550-99	Receiver Baseband Final Assembly
23	Ref	1841576-99	Receiver Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26	1	843262-1	Support Arm, Waveguide
27	1	843263-1	Clamp, Waveguide
28	Ref	88160-26	Gasket, Flat WR-42

PARTS LIST FOR 842754-3

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	842688-1	Mounting Channel
2	3	1841478-3	Receiver Assembly
3	2	1841727-3	WR-42 Waveguide Assembly
4	3	1841724-1	Circulator
5	3	1841726-99	Filter
6	1	842750-1	Pressure Block
7	1	89800-3	Pressure Valve, Schrader 91660060
8	1	1841725-1	WR-42 Waveguide Termination
9	24	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	24	188480-10	Flat Washer #10
11	24	188481-10	Lock Washer #10
12	Ref	88160-23	WR-42 Flexible Waveguide Assembly, 3 Ft.
13	40	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	12	188160-17	O Ring, Waveguide
15	3	842751-1	V-Block
16	4	189454-13	Screw, Soc. Hd. Cap 4-40 x 1-3;7 Lg
17	Ref	843821-2	Mounting Hardware Kit
18	Ref	808058-6	U-Bolt 7/16-14UNC, 4.5″ I.D.
19	Ref	188460-42	Nut, Hex 7/16-14UNC
20	Ref	188481-42	Lock Washer, 7/16
21	Ref	188480-22	Flat Washer, 7/16
22	Ref	1841550-99	Receiver Baseband Final Assembly
23	Ref	1841576-99	Receiver Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26	1	843262-1	Support Arm, Waveguide
27	1	843263-1	Clamp, Waveguide
28	Ref	88160-26	Gasket, Flat WR-42

PARTS LIST FOR 842754-4

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	842688-1	Mounting Channel
2	4	1841478-3	Receiver Assembly
3	3	1841727-3	WR-42 Waveguide Assembly
4	4	1841724-1	Circulator
5	4	1841726-99	Filter
6	1	842750-1	Pressure Block
7	1	89800-3	Pressure Valve, Schrader 91660060
8	1	1841725-1	WR-42 Waveguide Termination
9	34	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	34	188480-10	Flat Washer #10
11	34	188481-10	Lock Washer #10
12	Ref	88160-23	WR-42 Flexible Waveguide Assembly, 3 Ft.
13	56	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	16	188160-17	O Ring, Waveguide
15	3	842751-1	V-Block
16	4	189454-13	Screw, Soc. Hd. Cap 4-40 x 1-3;7 Lg
17	Ref	843821-2	Mounting Hardware Kit
18	Ref	808058-6	U-Bolt 7/16-14UNC, 4.5″ I.D.
19	Ref	188460-42	Nut, Hex 7/16-14UNC
20	Ref	188481-42	Lock Washer, 7/16
21	Ref	188480-22	Flat Washer, 7/16
22	Ref	1841550-99	Receiver Baseband Final Assembly
23	Ref	1841576-99	Receiver Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26	2	843262-1	Support Arm, Waveguide
27	2	843263-1	Clamp, Waveguide
28	Ref	88160-26	Gasket, Flat WR-42

PARTS LIST FOR 842754-5

ITEM NO.	QTY	PART NO.	DESCRIPTION
1		—	—
2	1	1841478-3	Receiver Assembly
3	1	1841727-3	WR-42 Waveguide Assembly
4	1	1841724-1	Circulator
5	1	1841726-99	Filter
6		—	—
7		—	—
8		—	—
9	10	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	10	188480-10	Flat Washer #10
11	10	188481-10	Lock Washer #10
12		—	—
13	16	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	4	188160-17	O Ring, Waveguide
15		—	—
16		—	—
17		—	—
18		—	—
19		—	—
20		—	—
21		—	—
22	Ref	1841550-99	Receiver Baseband Final Assembly
23	Ref	1841576-99	Receiver Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26	1	843262-1	Support Arm, Waveguide
27	1	843263-1	Clamp, Waveguide
28	Ref	88160-26	Gasket, Flat WR-42

PARTS LIST FOR 842754-6

ITEM NO.	QTY	PART NO.	DESCRIPTION
1		—	—
2	1	1841478-3	Receiver Assembly
3	1	1841727-3	WR-42 Waveguide Assembly
4	2	1841724-1	Circulator
5	2	1841726-99	Filter
6		—	—
7		—	—
8	1	1841725-1	WR-42 Waveguide Termination
9	10	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	10	188480-10	Flat Washer #10
11	10	188481-10	Lock Washer #10
12		—	—
13	24	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	6	188160-17	O Ring, Waveguide
15		—	—
16		—	—
17		—	—
18		—	—
19		—	—
20		—	—
21		—	—
22	Ref	1841550-99	Receiver Baseband Final Assembly
23	Ref	1841576-99	Receiver Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26	1	843262-1	Support Arm, Waveguide
27	1	843263-1	Clamp, Waveguide
28	Ref	88160-26	Gasket, Flat WR-42

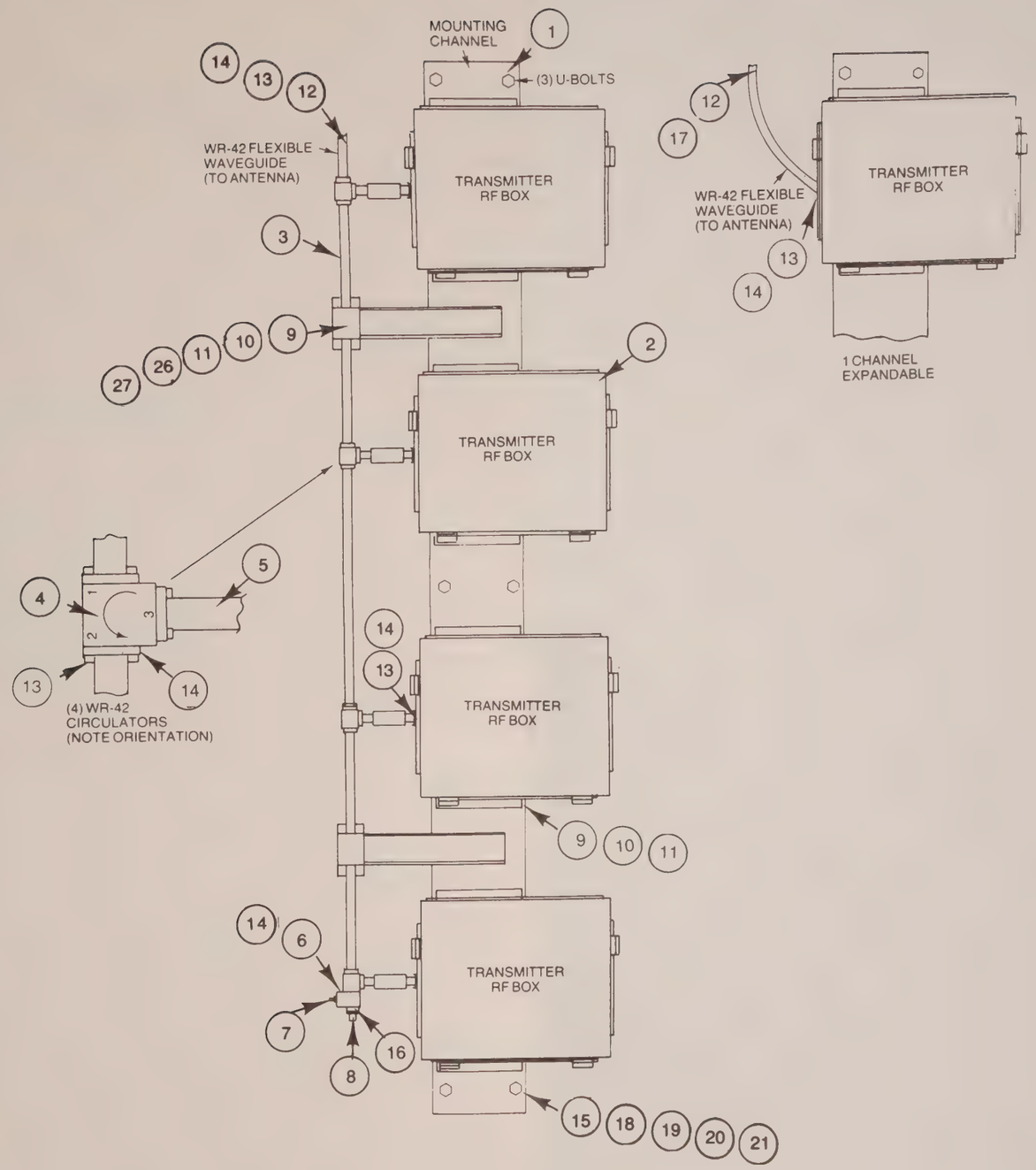

Figure 7-4. 23 GHz Transmitter Multiplex System Assembly PN 842755

PARTS LIST FOR 842755-1

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	842688-1	Mounting Channel
2	1	1841478-2	Transmitter Assembly
3		—	—
4		—	—
5		—	—
6	1	842750-1	Pressure Block
7	1	89800-3	Pressure Valve, Schrader 91660060
8		—	—
9	10	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	10	188480-10	Flat Washer #10
11	10	188481-10	Lock Washer #10
12	Ref	88160-23	WR-42 Flexible Waveguide Assembly, 3 Ft.
13	Ref	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	Ref	188160-17	O Ring, Waveguide
15	3	842751-1	V-Block
16	4	189454-13	Screw, Soc. Hd. Cap 4-40 x 1-3;7 Lg
17	Ref	843821-2	Mounting Hardware Kit
18	Ref	808058-6	U-Bolt 7/16-14UNC, 4.5″ I.D.
19	Ref	188460-42	Nut, Hex 7/16-14UNC
20	Ref	188481-42	Lock Washer, 7/16
21	Ref	188480-22	Flat Washer, 7/16
22	Ref	1841548-99	Transmitter Baseband Final Assembly
23	Ref	1840806-99	Transmitter Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26		—	—
27		—	—
28	Ref	88160-26	Gasket, Flat WR-42

PARTS LIST FOR 842755-2

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	842688-1	Mounting Channel
2	2	1841478-2	Transmitter Assembly
3	1	1841727-3	WR-42 Waveguide Assembly
4	2	1841724-1	Circulator
5	2	1841726-99	Filter
6	1	842750-1	Pressure Block
7	1	89800-3	Pressure Valve, Schrader 91660060
8	1	1841725-1	WR-42 Waveguide Termination
9	20	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	20	188480-10	Flat Washer #10
11	20	188481-10	Lock Washer #10
12	Ref	88160-23	WR-42 Flexible Waveguide Assembly, 3 Ft.
13	24	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	8	188160-17	O Ring, Waveguide
15	3	842751-1	V-Block
16	4	189454-13	Screw, Soc. Hd. Cap 4-40 x 1-3;7 Lg
17	Ref	843821-2	Mounting Hardware Kit
18	Ref	808058-6	U-Bolt 7/16-14UNC, 4.5″ I.D.
19	Ref	188460-42	Nut, Hex 7/16-14UNC
20	Ref	188481-42	Lock Washer, 7/16
21	Ref	188480-22	Flat Washer, 7/16
22	Ref	1841548-99	Transmitter Baseband Final Assembly
23	Ref	1840806-99	Transmitter Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26	1	843262-1	Support Arm, Waveguide
27	1	843263-1	Clamp, Waveguide
28	Ref	88160-26	Gasket, Flat WR-42

PARTS LIST FOR 842755-3

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	842688-1	Mounting Channel
2	3	1841478-2	Transmitter Assembly
3	2	1841727-3	WR-42 Waveguide Assembly
4	3	1841724-1	Circulator
5	3	1841726-99	Filter
6	1	842750-1	Pressure Block
7	1	89800-3	Pressure Valve, Schrader 91660060
8	1	1841725-1	WR-42 Waveguide Termination
9	24	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	24	188480-10	Flat Washer #10
11	24	188481-10	Lock Washer #10
12	Ref	88160-23	WR-42 Flexible Waveguide Assembly, 3 Ft.
13	40	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	12	188160-17	O Ring, Waveguide
15	3	842751-1	V-Block
16	4	189454-13	Screw, Soc. Hd. Cap 4-40 x 1-3;7 Lg
17	Ref	843821-2	Mounting Hardware Kit
18	Ref	808058-6	U-Bolt 7/16-14UNC, 4.5″ I.D.
19	Ref	188460-42	Nut, Hex 7/16-14UNC
20	Ref	188481-42	Lock Washer, 7/16
21	Ref	188480-22	Flat Washer, 7/16
22	Ref	1841548-99	Transmitter Baseband Final Assembly
23	Ref	1840806-99	Transmitter Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26	1	843262-1	Support Arm, Waveguide
27	1	843263-1	Clamp, Waveguide
28	Ref	88160-26	Gasket, Flat WR-42

PARTS LIST FOR 842755-4

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	842688-1	Mounting Channel
2	4	1841478-2	Transmitter Assembly
3	3	1841727-3	WR-42 Waveguide Assembly
4	4	1841724-1	Circulator
5	4	1841726-99	Filter
6	1	842750-1	Pressure Block
7	1	89800-3	Pressure Valve, Schrader 91660060
8	1	1841725-1	WR-42 Waveguide Termination
9	34	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	34	188480-10	Flat Washer #10
11	34	188481-10	Lock Washer #10
12	Ref	88160-23	WR-42 Flexible Waveguide Assembly, 3 Ft.
13	56	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	16	188160-17	O Ring, Waveguide
15	3	842751-1	V-Block
16	4	189454-13	Screw, Soc. Hd. Cap 4-40 x 1-3;7 Lg
17	Ref	843821-2	Mounting Hardware Kit
18	Ref	808058-6	U-Bolt 7/16-14UNC, 4.5" I.D.
19	Ref	188460-42	Nut, Hex 7/16-14UNC
20	Ref	188481-42	Lock Washer, 7/16
21	Ref	188480-22	Flat Washer, 7/16
22	Ref	1841548-99	Transmitter Baseband Final Assembly
23	Ref	1840806-99	Transmitter Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26	2	843262-1	Support Arm, Waveguide
27	2	843263-1	Clamp, Waveguide
28	Ref	88160-26	Gasket, Flat WR-42

PARTS LIST FOR 842755-5

ITEM NO.	QTY	PART NO.	DESCRIPTION
1		—	—
2	1	1841478-2	Transmitter Assembly
3	1	1841727-3	WR-42 Waveguide Assembly
4	1	1841724-1	Circulator
5	1	1841726-99	Filter
6		—	—
7		—	—
8		—	—
9	10	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	10	188480-10	Flat Washer #10
11	10	188481-10	Lock Washer #10
12		—	—
13	16	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	4	188160-17	O Ring, Waveguide
15		—	—
16		—	—
17		—	—
18		—	—
19		—	—
20		—	—
21		—	—
22	Ref	1841548-99	Transmitter Baseband Final Assembly
23	Ref	1840806-99	Transmitter Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26	1	843262-1	Support Arm, Waveguide
27	1	843263-1	Clamp, Waveguide
28	Ref	88160-26	Gasket, Flat WR-42

PARTS LIST FOR 842755-6

ITEM NO.	QTY	PART NO.	DESCRIPTION
1		—	—
2	1	1841478-2	Transmitter Assembly
3	1	1841727-3	WR-42 Waveguide Assembly
4	2	1841724-1	Circulator
5	2	1841726-99	Filter
6		—	—
7		—	—
8	1	1841725-1	WR-42 Waveguide Termination
9	10	88429-5	Bolt, 10-32UNF-2A x 1/2 Lg SST
10	10	188480-10	Flat Washer #10
11	10	188481-10	Lock Washer #10
12		—	—
13	24	189454-90	Screw, Soc. Hd. Cap 4-40 x 1-5/16 Lg
14	6	188160-17	O Ring, Waveguide
15		—	—
16		—	—
17		—	—
18		—	—
19		—	—
20		—	—
21		—	—
22	Ref	1841548-99	Transmitter Baseband Final Assembly
23	Ref	1840806-99	Transmitter Audio PWB Assembly
24	A/R	89893-29	Conformal Coating
25		—	—
26	1	843262-1	Support Arm, Waveguide
27	1	843263-1	Clamp, Waveguide
28	Ref	88160-26	Gasket, Flat WR-42

Figure 7-5. 23 GHz Multiplex Mounting Hardware Kit PN 843821A-2

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	4	88357-63	Connector Type F Male
2	4	88358-94	Connector Power 11 Socket
3		—	—
4	1	88160-23	Flexguide WR-42 3 Ft.
5	2	188160-17	Gasket, O-Ring WR-42
6	8	189454-90	Screw, Socket Hd. 4-40 x 5/16 Lg
7	3	808058-6	U-Bolt
8	6	188460-42	Nut, Hex 7/16 - 14
9	6	188480-22	Washer, Flat 7/16
10	6	188481-42	Washer, Lock 7/16

MP MASTER
MA29168